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Ministry of War Transport

Railway (London Plan) Committee  
1944

Report to the  
Minister of War Transport  
21st January, 1946

LONDON: HIS MAJESTY'S STATIONERY OFFICE

1946

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† Sir Theodore Thomas retired from the office of General Manager in October, 1945.



Ministry of War Transport

# Railway (London Plan) Committee 1944

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# REPORT

## TO THE RIGHT HON. ALFRED BARNES, M.P., MINISTER OF WAR TRANSPORT

Sir,

1. On the 22nd February, 1944, the Rt. Hon. Lord Leathers, C.H., your predecessor in office, acting in consultation with the Minister of Town and Country Planning, appointed us to be a committee with the following terms of reference:—

“To investigate and report upon the technical and operational aspects of those suggestions made in the County of London Plan of 1943 which relate to the main line and suburban railway system of London, both surface and underground, bearing in mind that these suggestions are intended to contribute towards and form part of a comprehensive scheme for the re-development of the area in question.

The Committee should include in their examination of the problem any alternatives to or modification of the suggestions made in the Plan which the Railway Companies or the London Passenger Transport Board may wish to submit and should have due regard to the requirements of traffic and to the convenience of the travelling public, and to any schemes of improvements which the Railway Companies and the London Passenger Transport Board may have in mind.”

We now have the honour to present the following report, which deals mainly with the problems arising in connection with passenger traffic.

We made an interim report in January, 1945, the substance of which is now incorporated in Part I of the present report.

2. We have benefited by close association with Mr. J. H. Forshaw, M.C., M.A., F.R.I.B.A., M.T.P.I., Architect to the London County Council, now Chief Architect to the Ministry of Health, and Mr. F. J. Forty, B.Sc., M.Inst.C.E., Engineer to the City of London. The former was joint author of the County of London Plan with Professor Sir Patrick Abercrombie, M.A., F.R.I.B.A., P.P.T.P.I.

Advantage has been derived from oral and written evidence submitted by officers of the Railway Companies and of the London Passenger Transport Board; also by certain members of the Council of the Institution of Civil Engineers.

In addition to the County of London Plan, we have taken into consideration the relevant recommendations of the City of London and Greater London Plans.



## PART I

### CHAPTER I

#### COUNTY OF LONDON PLAN

**3. Basis of proposals.**—Our terms of reference instruct us to consider the technical and operational aspects of the suggestions of the County of London Plan. But before doing so, it appears desirable to refer to certain fundamental expressions of opinion in the Plan, since these are the basis of the proposals with which this report is concerned. In paragraph 17 of the Plan, it is stated that :—

“ To the planner the most obvious external defects are the overhead lines carried on viaducts which impede re-development : the out-of-date character of some of the terminal stations, especially their faulty connection with the main road planning and the large area of central land locked up in sidings.”

The views set out in paragraph 21 are also fundamental with regard to our investigation :—

“ In relation to planning, London may be considered under three major aspects ; as a Community where people live, work and play ; as a Metropolis—the seat of Government and a great cultural and commercial centre ; and as a Machine, with special reference to the machinery of locomotion.”

We would also draw attention to paragraphs 42–44, referring to the railways, in which it is pointed out that :—

“ It must be a major objective in any plan for London to plan transport as a whole and to bring the railway and tube and road system into line with modern requirements and with the plan of general development. This cannot be achieved by mere ameliorative measures. A bold scheme is necessary, one which is devised to bring the whole system into conformity with the vastly increased size of present-day London as compared with its size a century ago . . . . A pre-requisite in any scheme of rationalisation, both as regards the lines and the station buildings, is electrification, on either a national or a regional basis . . . . The sinking of some of the overhead lines within the central and sub-central areas and the removal of three cross-river bridges is desirable ; their associated termini on the north bank being reconstructed as through stations in an underground system.”

**4. Railway viaducts.**—It is clear from paragraph 255, which deals specifically with the removal of viaducts, that the County of London Plan concerns the Southern Railway to a greater extent than the other main line companies. It is stated that “ From the planners' point of view the railway viaduct is probably the least satisfactory of the four different route levels within the central areas, more especially when the viaducts or river bridges obstruct road and water transport and surface development generally.” It is also stated that, on the south side of the Thames, the main approaches to the terminals “ seriously affect large areas, and within a three-mile radius of Waterloo there are over twenty miles of viaduct track, covering roughly two hundred and fifty acres and including several disused stations.”

Again, in paragraph 266, one of the planning objectives emphasised is “ the freeing of land and frontages for modern needs, thereby permitting the right use of land, and coherent growth.” In other words, a major planning objective lying behind the railway proposals in the Plan is to remove the existing railway bridges from the stretch of the Thames between Westminster Bridge and London Bridge, as well as the viaducts from the corresponding section of the South Bank.

We appreciate that, from the planners' point of view, it is generally desirable to abolish viaducts. But the railways carried by these viaducts should be regarded as essential instruments of transport rather than as obstacles to development. Viaducts or embankments can be pierced at will in a matter of months to make way for new roads of any width, just as cuttings can be readily bridged. Untidy development—which has arisen around and underneath viaducts, mainly as a result of insufficient control of building—should also be capable of correction.

**5. Recommendations in County of London Plan.**—The Plan contains two specific proposals for new passenger facilities which are intended “ to dispense with the need for the existing high-level approaches to head-on terminals at Charing Cross and Cannon Street, for the existing high-level stations at London Bridge and Waterloo Junction, and for their viaduct connections. All stations concerned would be replaced by underground ‘ through ’ stations on each loop.” These two projects are :—

(A) A new deep-level North Bank link (8 miles) from Battersea to Deptford, *via* Victoria, Charing Cross, Blackfriars, Cannon Street, Shadwell, Wapping and Surrey Docks.



(B) A new deep-level loop (6 miles) connecting Waterloo Junction, Charing Cross, Blackfriars, Cannon Street and London Bridge, and thence by tunnel *via* the Surrey Canal, rising to join the existing surface systems in the south and south-east.

Besides these two projects, the other main proposals in the Plan which affect the railways may be summarised as follows :—

(C) A north-south tunnel, an underground link to replace the existing viaduct from Snow Hill to Loughborough Junction.

(D) A northern arc suburban passenger route, passing below the main line stations at Paddington, Marylebone, Euston, King's Cross and Liverpool Street, with interchange facilities.

(E) The electrification of all lines leading into London from suitable interchange points.

(F) The separation of suburban traffic from main line traffic.

(G) The reconstruction of London Bridge, Waterloo and Fenchurch Street stations.

(H) Improvement of the northern terminals—Euston (to include St. Pancras), King's Cross, Paddington and Liverpool Street.

(I) The reconstruction of terminals at two levels, with flat roofs for future air landing.

(J) The provision of inner and outer goods rings, by utilising the northern half of the Inner Circle and by new construction.

6. It also appears appropriate to reproduce here the following extracts from the concluding paragraphs (638-640) of the Plan :—

"In our opinion, the removal (*a*) of Hungerford Bridge, (*b*) of the railway viaducts at Ludgate Circus and the tracks adjoining Blackfriars Bridge, and (*c*) of the loop partially encircling Southwark Cathedral, are of first importance. It would, therefore, be in accordance with our conception of the future of London if the railway suggestions relating to the riverside terminals and the south-west and south-east connections were investigated as matters of some urgency on account of the requirements of immediate post-war reconstruction in the adjoining areas.

The first two of the suggestions indicated above, or a combination or modification of either, would in our view justify first consideration; it would be, however, a matter for the special investigating body not only to decide on the merits of these and any other suggestions put to them, but also to determine the prospective order of execution of any undertaking decided upon so as to conform with all other considerations and arrangements that may be made to implement the County of London Plan."

**7. Cost of proposals in the County of London Plan.**—Thus, the recommendation of "first importance" is deemed to be the elimination of the railway viaducts and bridges serving Charing Cross, Cannon Street, Holborn Viaduct and Blackfriars stations, which it is proposed should be replaced at deep level.

Map No. 1, which illustrates, with minor modifications, those proposals in the Plan which we have denominated (A), (B), (C) and (D), was prepared at our request by the engineers whom we consulted, and served as the basis of their estimates of the cost of the civil engineering works. We estimate roughly that the expenditure involved in these four projects, at the pre-war price levels, would be not less than £110 millions; the calculations which have led us to this conclusion are set out in the Appendix to this report. If the post-war level of costs is 65 per cent. above the pre-war level, the total expenditure would be, say, £180 millions. We have not examined in similar detail the other proposals contained in the Plan; if adopted, they also would clearly be very costly.

In looking to the future over some decades, we are very conscious of the necessity for a reasonable and balanced solution of a problem of this magnitude, and the fact that great expenditure may ultimately be necessary does not deter us from impartial consideration of all that is involved. One of our most important tasks, if not the most important, is to review the proposals in the Plan to ensure that in future the travelling and trading public of London are afforded quicker, more comfortable and more convenient transport facilities than have hitherto been available.

It is also important to review the criticisms in the Plan so far as railways are concerned; they have already been briefly referred to, and we would be the last to deny that new facilities on a wide scale are required in relief of congestion. Improvements, however, in existing facilities, many of which are already well planned, must also play their part in the future transport plan. For instance, as regards terminal stations, which "are the most important gateways to the Metropolis" (paragraph 33), what the Plan calls "faulty connection with the main road system" (paragraph 17) can in some cases be remedied by replanning the roads with a view to serving the railways more efficiently.



## CHAPTER II

# INFORMATION REGARDING THE PRESENT RAILWAYS IN THE LONDON PASSENGER TRANSPORT AREA

8. **Layout of the railways.**—The present system is shown on Map No. 2, and the lines over which the services of the L.P.T.B. operate are indicated in yellow. The map also shows the additional railways and electrification embarked upon by the Main Line Companies and the London Passenger Transport Board under the £40,000,000 New Works Programme 1935/40 (*see also* paragraph 9). When this programme of new works has been completed, the railways in the London Passenger Transport Area will embrace a total of 1,156½ route miles made up as follows:—

## Route mileage of railways within the London Passenger Transport Area, divided between steam and electric operation as at the completion of the New Works Programme, 1935/40

<i>Owned or leased by</i>	<i>Electrified lines</i>	<i>Steam lines</i>	<i>Steam and Electrified lines (a)</i>	<i>Total</i>
Southern Railway ... .. (86% electrified)	419½	67½	—	486½
London and North Eastern Railway ... (26% electrified) (b)	54½	174	7¾	236¼
London Midland and Scottish Railway ... (32% electrified)	33¾	107½	17½	158½
London Passenger Transport Board ... (100% electrified)	137 (Route miles operated by Board—208)	—	—	137
Great Western Railway ... ..	4	53¾	8½	66
Joint Lines, etc. ... ..	32½	35½	4½	72¼
	681	437½	38	1,156½

Electrified lines per cent. of total: 60%.

Steam lines per cent. of total: 40%.

### Notes

- (a) Where electrified tracks run parallel with tracks solely operated under steam, they have been placed in this special category.
- (b) In only one instance has the mileage of parallel steam and electrified lines been counted twice, namely, between Harrow South Junction and Finchley Road, where the steam tracks owned by the London Passenger Transport Board, but leased to the London and North Eastern Railway, have no physical connection with the electrified tracks used by the Board's trains.

9. **New Works Programme, 1935/40.**—The projection of the L.P.T.B. Northern Line trains from Archway to High Barnet and Mill Hill East over L.N.E.R. tracks, and the extension of Bakerloo Line trains from Baker Street to Wembley Park and Stanmore over Metropolitan tracks, have already been put into operation. The remainder of the programme was held in suspense during the war, but many of the works are in an advanced stage. It is hoped that a portion of the western extension of the Central Line from North Acton to Ruislip, and the eastern extension in tube under the Eastern Avenue between Leytonstone and Newbury Park, over the electrified L.N.E.R. line to Ongar, and round Grange Hill loop, will be completed in two years' time to serve the new housing developments. For the same purpose, it is anticipated that the L.N.E.R. main line will be electrified between Liverpool Street, Fenchurch Street and Shenfield within the same time. The full programme also includes the projection of the L.P.T.B. Northern Line trains from Mill Hill East over the L.N.E.R. branch line to Edgware, and thence over a new railway to Bushey Heath, while the Northern-City Line trains will operate over the L.N.E.R. Alexandra Palace, High Barnet and Edgware branches. In addition, the Metropolitan and Great Central Joint Line will be quadrupled between Harrow and Rickmansworth, and electrified between Rickmansworth and Amersham, including the Chesham branch.

10. **Passenger traffic before the war.**—The following table shows the total number of passenger journeys originating on the railways within the London Passenger Transport Area for



each of the years ended 30th June, 1934 to 1938, the latter being the last year free from the influences of war :—

	Year ended 30th June				
	1934	1935	1936	1937	1938
G.W.R.	24,774,000 100	25,538,000 103	26,087,000 105	27,190,000 110	26,507,000 107
L.M.S.R.	99,374,000 100	105,779,000 106	111,175,000 112	117,134,000 118	118,002,000 119
L.N.E.R.	115,115,000 100	118,684,000 103	122,406,000 106	125,972,000 109	125,358,000 109
Southern	251,799,000 100	261,421,000 104	270,283,000 107	284,890,000 113	285,492,000 113
Joint Lines	34,834,000 100	35,670,000 102	37,042,000 106	39,583,000 114	38,964,000 112
	525,896,000 100	547,092,000 104	566,993,000 108	594,769,000 113	594,323,000 113
L.P.T.B.	415,882,000 100	445,888,000 107	467,870,000 113	509,959,000 123	487,749,000 117
	941,778,000 100	992,980,000 105	1,034,863,000 110	1,104,728,000 117	1,082,072,000 115

This traffic represents suburban passenger movement only, and its magnitude is unparalleled in any other part of the country.

11. **Terminal traffic at morning peak hours.**—To afford an indication of the volume dealt with at the principal terminals, the following table shows the estimated number of passengers (suburban and long-distance) arriving during the morning peak hours on a typical pre-war weekday :—

		Total Number of Passengers Arriving	
		Throughout morning peak hours 7 a.m. to 10 a.m.	During maximum morning peak hour
G.W.R.	Paddington	12,200	4,800
L.M.S.R.	Euston	10,000	5,800
	St. Pancras	3,500	2,100
	Broad Street	11,600	6,000
L.M.S.R. & L.N.E.R. (Joint)	Fenchurch St.	17,300	10,500
L.N.E.R.	King's Cross	18,000	9,000
	Liverpool Street	72,000	34,700
	Marylebone	7,700	3,900
S.R.	Waterloo	47,000	24,300
	Victoria	34,200	16,400
	Charing Cross	37,100	17,000
	Blackfriars	25,100	13,700
	Holborn Viaduct		
	Cannon Street	34,700	18,100
	*London Bridge	60,000	31,300

\* Note.—10 per cent. of the passengers arriving at London Bridge interchange and proceed to other terminals



## CHAPTER III

## THE COMMITTEE'S APPROACH TO THE PROBLEM

12. **The passenger transport problem of London.**—We think it well to state briefly what we conceive to be some of the basic and practical considerations relating to the rail and road transport problem of the Metropolis, as regards urban and suburban traffic. As a broad principle, advantage should be taken of the superior speed and safety of the railways for the longer distances to relieve congestion on the roads, leaving slower road services, with their closer and more intimate access to starting point and destination, to deal with shorter journeys and to fulfil their indispensable function as a feeding and distributing agency for the railways.

There will always be some overlapping, but the two systems should not be regarded as competitive; we agree with the Plan that the passenger transport problem must be considered as a whole, with a view to the closest co-ordination in the interests of the travelling public. While a longer daily journey, measured in *distance* to and from work, may have to be accepted, this is not necessarily a disadvantage to the individuals concerned (who are really those who matter) if overall journey *time* can be reduced and the standard of comfort improved. Equally important is the provision of suitable arrangements for interchange from one agency to the other with the shortest possible walk and the least exposure to weather.

It follows that the nearer stations can be to the localities served, the better will be the facilities for daily travel, and proper planning must take full account of the convenience of the regularly travelling public, whose point of arrival by rail should be sufficiently near to their place of work not to add unnecessarily to their expenditure of time and energy or, incidentally, to the task of the roads. Indeed, it is fortunate that past railway competition has brought about a profusion of stations in London conveniently placed for business communities, and it is more than ever necessary to retain them as close as possible to the centre. The resulting spread of their daily inflow and outflow has been an advantage rather than a disadvantage, and proposals for the fusion of terminals should be approached with caution, in view of repercussions on road and underground traffic. Moreover, physical limitations of gradient and curvature are so much more stringent for railways than for roads, that re-location of the latter to suit existing railway sites is likely, in general, to prove less costly in works.

The network of underground railways in London is justified by the necessity for linking the main line terminals, and for relieving, but not for competing with, road transport. The growing tendency has been to interlink these services with the main line systems; new developments, for instance, provide for inter-running in the west, east and north, where tube trains come to the surface and run over main line suburban tracks. This principle, however, should be applied with discrimination, as tube rolling stock does not provide the necessary degree of comfort for outer suburban travel; moreover, extension of such services, if carried too far, may defeat its object by creating congestion, overcrowding and loss of speed in the central sections. In our view, future construction of underground express lines in Central London, to take standard size rolling stock, will be necessary to increase speed and comfort, with cross-platform inter-change to local lines wherever practicable.

The foregoing merely illustrates the general lines on which we have approached the problem before us. Different examples will require different treatment, in which the merits of existing facilities must be borne in mind in the consideration of measures to remedy their defects; we are of the opinion that improvement and adaptation, wherever they will serve the purpose, are preferable to sweeping physical changes.

13. **Need for improvement.**—There are two matters of fundamental importance that we have to consider before embarking upon the technical details of a plan for development of the railway system in the London area. The first is to ask the question whether a large-scale development plan is called for, or whether, with comparatively minor adjustments, the London railway system could be adapted to the public needs. The second is to inquire whether the next few decades are likely to see a rising or falling volume of railway traffic in the London area. These questions are clearly fundamental, for if the present system is well adapted to traffic and other needs and those needs are themselves about to decline, it would be difficult to justify any further large expenditure of money.

The County of London Plan gives a clear answer to the first question. In the view of its authors, the London railway system has many defects and disadvantages. We do not, as a Committee, associate ourselves with all of these strictures. In our view, the London railways carry an enormous volume of traffic with a high degree of efficiency and convenience to the public; traffic flows and the facilities for handling them have, over a hundred years, naturally adapted themselves to each other, and London is at least as well served as any other great metropolis. On the other hand, we would not wish to deny that there is considerable scope for improvement. The London railway system was largely developed by a number of separate companies when the Metropolis was smaller in size and population, and before the principles of town planning and traffic co-ordination held the prominent place they do to-day. Much has been done over the years to co-ordinate the early railways and to link up the constituent lines so as to secure inter-working and increase the efficiency and convenience of the services. Nevertheless, many parts of the inner London zone are still poorly served by railway facilities, and there are heavy traffic flows, suitable for rail transport, now forced to rely on road services. Moreover, the majority of the main line terminals and/or their approach lines have become congested with the growth of suburban and long-distance traffics.



Beyond the inner zone there are many suburban districts where, if pre-war experience is any criterion, electric services should replace steam services without delay, and other districts where improvements are urgently needed but cannot be effected mainly because of in-town terminal or track congestion. We are in agreement with the views expressed by the authors of the County of London Plan that at peak periods there is congestion on certain sections of railways, that the policy of electrification should be pursued, that the connections between the northern and southern main line terminals are incomplete, and that closer relationship between the tube and main line railway systems is required. Our approach to the problem is that the railway system should remain substantially as laid out to-day, modernised where necessary, and adapted to meet, so far as is practicable, town-planning requirements; on this framework we would superimpose certain new railways designed to strengthen what exists and to afford additional facilities of lasting value.

**14. Future volume of traffic.**—To the second fundamental question, whether the volume of traffic can be expected to increase, the County of London Plan does not provide so unambiguous an answer. One of its aims is stated to be to reduce the length of the average journey between home and workplace; and this is even more emphatically argued in the Greater London Plan. On the other hand, the Plan proposes to spend considerable sums not merely on altering present railway facilities where they impede re-planning, but also on developing facilities for traffic reasons, which seems to imply an assumption that new or extended facilities will be needed.

Our own views on this question are set out in paragraphs 19 to 22 below. It is enough for the moment to say that, for the reasons there stated, we have proceeded on the assumption that the volume of traffic to be carried on the London railway system as a whole will continue to increase in the years ahead.

We therefore approach the proposals of the County of London and Greater London Plans on the double basis that a large-scale plan of development is needed, and that it should provide facilities for an increase in travel in the London area.

**15. Conclusions on principles.**—After hearing evidence from the engineering and traffic experts already referred to, we have arrived at the following conclusions on general principles:—

(a) *Electrification.*—The County of London and the Greater London Plans propose the electrification of all railways in London. As a general proposition we endorse this, but we would not exclude diesel traction. All suburban traffic on the Southern Railway is already electrified; and our proposals as developed later in this report would necessitate the electrification of almost all other suburban services in the Greater London area not already electrified. So far as concerns long-distance traffic, the Greater London Plan proposes that there should be interchange points between steam and electric traction at places some 20 to 40 miles out of London. We are not certain that this would be practicable on all main lines; and if not, the electrification of the passenger and freight services concerned would necessarily form part of the wider question of main line electrification, which is outside our terms of reference.

(b) *Inter-running.*—The existing underground system and extensions thereof should in general be separated from the tracks of the main line companies, so far as inter-running is concerned, having regard to the possibility of adverse operational effects of the one on the other. But the projection in tunnel of standard-size rolling stock across London is to be recommended, so long as lay-by accommodation can be arranged.

(c) *Loop working.*—Loop working, as advocated in the County of London Plan, is not a practicable proposition for terminating trains. We have examined this proposal in detail and are satisfied that such working would afford no advantages but, on the other hand, would have serious disadvantages. To introduce loops on the scale which has been proposed, and which would be required to deal with the very heavy traffic on the Southern Railway, would necessitate extremely complicated junction working, with numerous burrowing junctions or fly-overs at the entrance to and exit from the loops to avoid conflicting movements on the level. Such movements would severely reduce the capacity of the lines. If, to meet the requirements of the Plan, this network of lines were placed underground, vast tunnelling schemes would be involved—assuming it to be an engineering possibility.

So far as main line services are concerned, time must be allowed to deal with the loading and unloading of passengers, luggage and parcels, and the servicing of restaurant cars and lavatories before trains can be dispatched. Moreover, it is essential to provide a margin of recovery time to ensure a punctual start on the return trip. The holding of trains for these various purposes is irreconcilable with the principles of loop working. Even if loops were constructed on an entirely new set of conditions would arise at the stations on the loops, and the provision of a large number of platforms at certain stations would be essential in order to provide for the long station stops and lay-by time.

Presumably if loop working is right and proper for trains on the Southern Railway, some form of loop working should be similarly applied to the trains arriving at the terminals on the north side of London. We feel that a series of loops in the north and a series of loops in the south would be no substitute for through working—*vide* (b) above.



(d) *Stations and tunnels*.—It would be impracticable to meet at deep level all the following requirements of a main line passenger station:—

- (i) Efficient means of transfer between street and train for passengers and a vast volume of luggage, mails, newspapers and general parcels traffic, including fish and fruit.
- (ii) Provision of an ample concourse in close proximity to the trains to allow regulation of passengers to various destinations, especially at peak periods and holiday seasons.
- (iii) Ancillary passenger amenities—as near the trains as possible—including waiting and refreshment rooms, cloakrooms, bookstalls, booking and information offices, telephones and lavatories.
- (iv) Sufficient platforms to allow trains for the longer distances to remain in the station an appreciable time for loading and unloading of passengers, luggage and parcels, and for seat reservation procedure.
- (v) Servicing of trains, including routine inspection, cleaning of incoming to form outgoing services, replenishing of lavatory vehicles and re-stocking of refreshment cars, etc.

It would be practicable, on the other hand, for standard size rolling stock—with sliding doors—in suburban traffic to operate to deep level stations, provided it is possible to arrange a considerable reduction in heavy luggage and parcels traffic without public inconvenience.

It would also be practicable to provide sub-surface terminal facilities, say 20 feet to 30 feet below road level, although this is dependent to a large extent on electrification, the actual site, the gradient, and the means of road access. In reconstruction of terminals consideration should be given to the advantages of double-decking, as well as to the provision of a flat roof.

#### CHAPTER IV

### CONCLUSIONS ON RAILWAY PROPOSALS IN THE COUNTY OF LONDON PLAN

**16. Proposed new railways** (see paragraph 5).—It follows from the general conclusions mentioned in paragraph 15(c) and (d) that we cannot commend what is perhaps the major specific railway proposal in the Plan—namely, a deep-level loop from London Bridge to Waterloo, Charing Cross, Cannon Street, and back to London Bridge (Project B).

The proposed deep level North Bank link from the vicinity of Clapham Junction to Deptford (Project A) would involve the difficulty of deep level lay-by accommodation referred to in paragraph 15(c), and would not (having regard to the conclusion expressed in paragraph 15(d)) achieve the intended elimination of surface stations for main line trains. Moreover, as a route for suburban trains only, while affording passengers proceeding to the North Bank some advantages in certain cases over the existing facilities, it would deprive passengers to and from the South Bank stations of the existing through trains that they enjoy to-day. It does not, in any case, meet the known demand for direct facilities through from south-east to north-west and from south-west to north and north-east.

We are impressed with the advantages to the amenities of London which will accrue from the proposed North-South tunnel (Project C), and, since it appears to be feasible both from the operational and the engineering points of view, and also offers some positive gain as regards gradient, we recommend this proposal.

We have not considered the proposed northern arc suburban passenger route (Project D) in any detail, but *prima facie* our view would be that, if any new underground works were undertaken in respect of the northern terminals, the lines should run directly across Central London, rather than round its margin as proposed in the Plan.

**17. Charing Cross and Cannon Street.**—Charing Cross Station and Bridge have been the subject of recommendations by many bodies in the past, *i.e.*, the Select Committee of the House of Commons (May, 1930), the Advisory Committee appointed by the London County Council—usually known as the Scott Committee—(March, 1931), and the London and Home Counties Traffic Advisory Committee (1936 and again in 1938). We have found these reports of value and have taken note of their conclusions. The scope, however, of our inquiry is related to the full-scale planning of London, and therefore permits a wider review of the problem.

From this standpoint the merit of a clean sweep of the three rail bridges over the Thames between Westminster and London Bridge cannot be denied. On the other hand, if this were done, we attach the utmost importance to the provision not only of equivalent but of improved alternative railway facilities, particularly as the existing Charing Cross and Cannon Street services and the cross-river tubes are already congested. We have taken these factors into account in our recommendation (paragraph 16) for the adoption of Project C; this would provide deep level stations at Blackfriars



and Holborn, and would facilitate the full and free re-development of a  $1\frac{1}{4}$  mile stretch of South Bank river-front not intersected by surface railway between Hungerford and Cannon Street bridges.

We have also given serious consideration to the placing of Charing Cross and its approaches at deep level, in connection with both the loop working proposed by the Plan and alternatives. In view, however, of the nature of the traffic dealt with at Charing Cross, we are satisfied, having regard to the expert evidence that has been given, that there would be grave difficulties in providing adequate facilities underground for dealing with the whole of it, let alone a margin for improvement. As we have already stated in paragraph 15(d), we do not consider that long-distance trains can satisfactorily be handled, or a main line terminal worked, at deep level.

On the other hand, we are impressed with the desirability on planning grounds of improving London's amenities by removing this surface station and its viaduct approaches when in the future this becomes practicable. We are also impressed with the necessity for formulating proposals for the long-term betterment of London's transport facilities as a whole. Both elements, in fact, are much to be desired, namely a definite improvement in the transport facilities available, and the removal of the bridges, viaducts and stations concerned.

But alternative facilities must be provided before the existing facilities are removed and, urgent though the clearance of the South Bank is from the planning point of view, a large programme of works, extending over many years, would have to be executed before the new facilities would be adequate to carry the traffic served by the surface lines in this area. Thus, though a solution of the problem on these lines may be possible, it would not be an immediate solution.

Nor would it be a cheap solution. The provision of additional facilities could be expected to create some additional traffic, but the revenue to be derived could not be expected to be more than a small fraction of what would be needed to provide commercial justification for a programme of the magnitude involved. Yet without a comprehensive scheme it would be impossible both to improve transport facilities and to clear the South Bank. Anything smaller or cheaper would inevitably fail in one respect or the other; this is not a matter in which half-measures bring half-returns.

Those parts of a full scheme which would fully replace Charing Cross Station and Hungerford Bridge would at the best take a number of years to complete; in this connection, it must be borne in mind that there would be a demand at the same time for labour, material and skilled professional services to carry out other transport works to meet urgent traffic requirements. In view of this, it would not be reasonable, or in the interests of the travelling public, that the Southern Railway should continue to be inhibited during this interim period, which is likely to be prolonged, from carrying out improvements to the present station and its approaches.\*

The question of Cannon Street, is, in most respects, similar to that of Charing Cross. Both stations are terminals for trains from the same districts and the lines diverge at London Bridge Station. Both have a very large daily traffic, which could not be displaced until alternative facilities are provided. We recommend that a similar policy should be followed in both cases.

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\* The restriction referred to is contained in Section 10 of the South Eastern and London, Chatham and Dover Railways Act, 1917, which precludes the Company from carrying out work for the enlargement or improvement of Charing Cross Station.



## PART II

### CHAPTER V

#### RAILWAY DEVELOPMENT AS RELATED TO HOUSING AND INDUSTRY

**18. Introduction.**—With the exception of a single proposal—a new North-South tunnel from Snow Hill to Loughborough Junction—we have thus found ourselves unable to accept the major proposals of the County of London Plan for new railways. On the other hand, we appreciate the reasoning which led the authors of that Plan to make their proposals; we might differ from them on some of their arguments, but on the other hand we are even more impressed than they appear to have been with the need, for traffic reasons alone, for undertaking major works to improve the existing facilities. It is, therefore, clearly incumbent upon us to state what alternative scheme we should substitute for the Plan's proposals. To this task we now turn.

**19. Future volume of traffic.**—Before any proposals can be drawn up for extensive development of the railway system in the London area, it is first necessary to form some idea of the probable future volume of traffic. If this is now at a maximum and only declines can be expected for the future, anything in the nature of the extension of facilities would clearly be inappropriate. It would rather be necessary to see where retrenchments were possible.

The factors which affect the volume of traffic and the provision of transport in the London area are:—

- (i) The future population of the area.
- (ii) Its distribution within the area.
- (iii) The extent to which workers live in the suburbs and work in the centre of the area.
- (iv) Social habits in the matter of travel.
- (v) The magnitude of the peak in the "rush hours."

For our purpose, these factors require to be studied in relation to the whole of Greater London, for the system even in the inner central zone is conditioned by what takes place beyond.

**20. Size and distribution of population.**—For many decades past, London has embraced a rising proportion of the total population of the whole country, which has itself been rising. During the inter-war years approximately half of the increase in London's population could be attributed to immigration from the provinces, and, if the tendencies of these years were to continue unchecked, further immigration could be expected, even if the total population of the country were to remain stable. The Barlow Commission recommend that further immigration should be checked, and this recommendation appears to have been accepted in principle by the Government. It is still too early, however, to see how effectively the policy will be enforced, and for our purposes we have assumed that the total population of the Greater London area will remain stable for the next generation. If, after that time, the population of the whole country is falling, some decline in the Greater London area (though at a slower rate) should presumably be expected. But this is both uncertain and still somewhat remote.

The distribution of population changed substantially within the area in the inter-war years. There was a considerable migration of *residence*, but not to nearly the same extent of *workplace*, from the County of London to the inner and outer suburban rings. This appreciably added to the demand for transport. In the absence of public intervention to the contrary, these tendencies may be expected to continue, with a consequent further demand for transport facilities. So far as the residence of the population is concerned, the County of London and Greater London Plans are calculated to reinforce the natural tendency, since there is to be a considerable emigration from the County of London. Indeed, Plan or no Plan, it is obvious that a great deal of the new housing must be well out from the centre.

**21. Decentralisation of employment.**—So far as concerns workplace, however, the proposals of the Plans run in a contrary direction, for it is one of their guiding principles that industry also should be de-centralised; and there are proposals for satellite towns to be located, and existing towns expanded, beyond the green belt, in which it is intended that considerable numbers of people shall find homes and work in close relation to each other. If this conception were fully realised, it is possible to imagine a smaller volume of travel in spite of a wider distribution of the population.



Indeed, the Greater London Plan makes it clear that this is its intention and hope, and speaks in one passage of a 20 per cent. reduction in the total volume of travel in London.\*

If this were likely to be true, our report could stop at this point. A few local adjustments to the railway system would no doubt still be worth carrying out. But it would clearly be foolish, in such circumstances, to spend money on major schemes. The present railway system was not so badly overstrained in peacetime that it could not carry with ease a volume of traffic reduced by one-fifth. But we do not believe that the expectation of a reduction from this cause is likely to be realised.

In the first place, though new satellite towns may be built and others expanded, we do not think it likely that compulsion will be used either to limit residence in them to those who work there or to limit their industries to local labour. Yet in the absence of compulsion there will be a great deal of cross-travelling. Indeed, it is necessary that it should be so, since a lively and successful metropolitan industry is largely dependent on the mobility of its labour force, and it is improbable that the worker would be prepared to sacrifice the economic advantage conferred on him by the ready availability of a wide potential market for his services.

In the second place, the great bulk of the regular passenger traffic on the suburban railways is represented by the business movement to and from the inner zone, which is associated with the administrative and distributive functions of that zone. There is a large secondary traffic attracted by the social and amusement facilities of the central zone. The scope for decentralisation of these non-manufacturing functions is smaller than is the case with industry, and the volume of traffic to which they give rise will clearly be greater if the population is dispersed.

When both these sets of considerations are taken together—those relating to industry and those relating to the administrative, commercial and social functions of the metropolitan centre—we feel confident that a greater dispersion of population will mean a greater volume of traffic. The combined dispersal of population and industry should have the effect that the increase in travel will be smaller than it would otherwise have been, but there will still be an increase. It is inconceivable that new towns with populations up to 60,000 could be established within the sphere of metropolitan influence without creating an appreciable daily traffic to and from the centre.

**22. Increasing traffic.**—Above all, there is the question of social habits. Experience shows that, as income rises, the demand for transport rises more than proportionately, irrespective of transport to and from work. No doubt this tendency will continue and the institution of holidays with pay will reinforce it.

Apart from the disposition of commercial and industrial activity and of the residential areas, and the magnitude of the total population, there is the question of the provision that has to be made for the peak. In recent years there has been a progressively greater concentration of traffic movement into the peak hours, brought about by the shortening of working hours and their greater standardisation. Staggering of working hours on a really effective basis has not hitherto proved acceptable in the inner zone, and it must be admitted that the prospect of securing material relief by breaking down peak hour concentrations is not encouraging. We consider, therefore, that in the development of London's railway system, this unfortunate trend must be recognised and some provision made to meet it.

For all these reasons, we have based our proposals on the assumption that the volume of travel in the London area, as measured in passenger journeys and still more in passenger-miles, will continue to increase.

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\* The following passage occurs in Chapter 14 (ii) of the Greater London Plan :—

" In considering one or other of the various proposals which have been mentioned in earlier chapters, there may be those who ask ' Can we afford it ? ' The correct answer is often another question, ' Can we afford to do without it ? ' Among such cases a glance may first be given to one of the fundamental proposals, namely, that the place of work should be conveniently situated for the worker."

" According to the Barlow Report (paragraph 358), the London Passenger Transport Board calculate that the burden of cost which falls upon the average family in London for transport is about £15 per annum. To obtain the money to pay for this £15 each year, the sum of £500 could be invested in 3% Savings Bonds, yielding £15 a year in interest. In other words, the capital cost of transport for the average family is £500. Thus, the capital cost of transport for 1,500,000 families living in the environs of London may be estimated at  $£500 \times 1,500,000 = £750,000,000$ . When the Plan is fully carried out, one result will be to reduce daily travel to work. We may, therefore, with confidence, reduce the average cost of transport by 20%, from £15 a year to £12 a year per family. The total capital cost of transport will thus be reduced from £750,000,000 to £600,000,000, a saving of £150,000,000, and this modest sum might thus accrue as one of the financial benefits due to the Plan."

Apart from the question of whether a 20 per cent. reduction in travel is, in fact, likely, which is argued above, the calculation of the money saving requires some comment. Had the volume of traffic never been greater than four-fifths of its present volume and had the provision of transport facilities been similarly limited, then it might be true that the annual expenditure would also be smaller in the same proportion. But the facilities do exist and it is notorious that the cost of running a transport undertaking cannot be reduced *pari passu* with any reduction of traffic. If the traffic wholly ceased on one-fifth of the railway mileage, then those lines could be abandoned—though, even then, the continuing burden of their original cost would be borne by someone. But the reduction that the Author of the Plan has in mind is a general overall reduction on all forms of transport in the metropolitan area. It would be extremely difficult to reduce the services in the same proportion, so that even current expenses, such as wages, would show comparatively little fall. And so long as the capital facilities—the railway tracks, tunnels, stations, etc.—continued to be used at all they would have to be maintained and amortised. If, contrary to all immediate probability, the volume of travel in the London area were to fall off by one-fifth, the average fare would have to be increased by an amount that would reduce the annual saving to a very small figure.

It is also pertinent to point out that, however large the annual saving that might accrue to the individual inhabitants of the area through a reduction in the volume of travel, such saving would not be available for financing additional expenditure by transport undertakings or public authorities unless a special tax, or some other kind of levy, equal in amount to the saving, were imposed upon the population.



## CHAPTER VI

## GENERAL OBSERVATIONS ON THE COMMITTEE'S PROPOSALS

**23. Introduction.**—We consider that the proposals submitted in this report would be practicable from the operating point of view, and would confer marked immediate benefits on the travelling public, while providing for long-term improvement in the transport facilities of the whole Metropolis. We have had regard primarily to considerations of traffic and passenger convenience, and we have made no attempt to study the complex engineering considerations involved, which would have prolonged the inquiry for many months and required qualified staff and resources not now available. Nor have we made any attempt to examine the legal and financial considerations that would arise.

The construction of new underground railways in Central London on a scale implicit in our proposals is bound to give rise to major engineering problems, the solution of which may well lead to modifications of any scheme devised mainly from the traffic point of view. This is an important reservation, and one which must be borne in mind in considering our proposals. Moreover, they have not been examined officially by the Main Line Companies or by the London Passenger Transport Board, and it will be appreciated that under no foreseeable traffic conditions could they be regarded as commercial propositions; but it is apparent that relief to the railway system in the inner central zone is an essential pre-requisite to material development in the suburban and outer areas.

**24. Method of investigation.**—Our proposals take their origin from two different sets of requirements. The first requirement is to enable Charing Cross, Cannon Street, Blackfriars and Holborn Viaduct stations, and the bridges and viaducts leading to them, to be removed. Though the proposals we make for this purpose will, we believe, improve traffic facilities, they would not be made if traffic considerations alone were dominant. In fact, they are, at least in origin, an attempt to meet the aims of the County of London Plan as regards the replanning of the South Bank. These proposals are set out in detail in Chapter VII. Secondly, we have made proposals which, though we hope they will assist planning, are primarily intended to serve traffic requirements. These are set out in Chapter VIII. Although it is impossible to draw a rigid distinction between the provision of rail transport and the other considerations that enter into planning, it should be realised that our proposals would not have taken their present form if we had been following either approach exclusively.

**25. Fundamental principles.**—Our proposals are based on the following premises from the traffic point of view:—

- (i) Trains from the suburban stations on the Eastern Section of the Southern Railway (other than those to Victoria) should reach the City and the West End in tunnel.
- (ii) Similarly, trains from the suburban stations on the Central Section (at present terminating at London Bridge) should be extended into the City in tunnel. (Trains from the Central Section serve the West End at Victoria.)
- (iii) Suitable provision should be made for a terminal on an appropriate site for the main line trains at present using London Bridge, Cannon Street, Charing Cross and Holborn Viaduct.
- (iv) Provision should be made for the retention of facilities for passengers from the Eastern Section to reach Waterloo to connect with Western Section trains.
- (v) The tunnels connecting with the main line system should be of a diameter to take standard size rolling stock.
- (vi) Account should be taken of the known demand for direct facilities across London.
- (vii) The whole scheme should be of such a nature that on balance a marked benefit immediately accrues to the travelling public, provision being made for long-term improvement in the transport facilities of the Metropolis.

**26. Through running across London.**—If the Southern Railway Company's suburban trains are projected underground through the City and West End, it seems essential to carry the projection through the inner zone and effect communication with suitable suburban routes on the other main lines; also to design the train services so that provision is made for through operation from one side of London to the other, so far as traffic conditions warrant. In this way, the facility of ready access to the inner zone will become available to passengers from the northern and western lines as well as from the south.

**27. Type of electrification and inter-running.**—It should be noted that, whereas the Southern Railway have adopted a third-rail system of electrification, the London, Midland and Scottish and the London and North Eastern Railways have decided to adopt an overhead system. Methods to facilitate the inter-running of both passenger and freight services will require to be the subject of technical study.

**28. High speed operation.**—The new railways should be designed for high speed operation and treated as trunk routes in the London railway system. The number of in-town stations should therefore be limited, and these should be located as nearly as physical conditions permit to focal points on the existing underground lines. The new trunk lines would be a system of a specialised character, meeting the requirements of the suburban and outer-suburban traffics, super-imposed on



an underground network primarily serving local urban needs. Such a conception implies that the new railways would be fully integrated with the underground system, with adequate interchange facilities.

**29. Regularity of service.**—If the proposed system of new railways in tunnel is to achieve success, it is axiomatic that the train services thereon should be scheduled at standard times throughout the day and that every possible step should be taken to ensure punctuality in running. The trains would serve many suburban routes, no less than 16 on the Southern system under the existing London Bridge Station alone, and irregularity during the peak hours could only result in confusion (if not chaos) in the distribution of the traffic. Experience on the Southern Railway shows that the passenger is greatly assisted by the adoption of standard running times, for it could not be contemplated that with such a variety of services it would be practicable (or necessary for traffic reasons) to operate services at a frequency which would enable public timetables to be dispensed with.

**30. Recovery time and reversing facilities.**—To ensure punctuality it is essential in compiling the schedules to allow a small margin of recovery time en route (perhaps of the order of 2 minutes) on through journeys of a length of 30 miles or more. Such an allowance is required to enable minor delays to be recovered and to provide opportunity for service adjustments. With terminal operation such delays are taken care of, and service adjustments are effected during the layover period at the terminal station. This need postulates the provision at "strategic" stations on or adjacent to the new railways of duplicate track and platform accommodation.

Thus, to take as an example the suggested Route 4 (see paragraph 39) which may be projected in the north to St. Albans and Harpenden, and in the south would be linked with the surface lines to Gravesend, there might be a through service from Harpenden to Gravesend. It may well be, however, that the traffic will not, in fact, justify a balance of service requiring every train to be operated over the entire length of the suggested route, apart from the contingency that a portion of the service would not be projected beyond St. Albans. Indeed, having regard to housing developments, the chances are that in the initial stages of this scheme, a greater volume of service will be required between the central area and the southern limits of the route than between the central area and the northern districts. In these circumstances, economy of operation would necessitate the provision of reversing facilities in the central area.

We anticipate that reversing facilities and recovery time accommodation would have to be provided at the new underground stations to be located under the main line surface terminals at Tower Bridge Road, Euston, Marylebone and Paddington; also, in so far as the Loughborough Junction-King's Cross line is concerned, at Waterloo and King's Cross. This arrangement would have the advantage of providing the extra time at stations where a heavy interchange of passengers would take place and where luggage and parcels traffic would have to be handled. Thus, to take Route 4 again as an example, trains from the south requiring to be reversed in the central area would terminate at Paddington, while trains to be reversed from the north would terminate at Tower Bridge Road. As regards recovery time for through services, the morning trains from the south would be allotted such time at Paddington and those from the north at Tower Bridge Road; but probably for the remainder of the day, and certainly during the evening, the position would be reversed to accord with the flow of traffic, and the through services from the south would be allowed recovery time at Tower Bridge Road and those from the north at Paddington.

**31. Segregation of suburban services on surface lines.**—The lines beyond the inner zone which would be used by the suburban passenger services running over the new railways are also in most cases now used by main line and outer-suburban passenger trains and by local and long-distance freight trains, the operation of which might seriously interfere with the regularity of the suburban services. Long-distance passenger trains and all freight trains are exposed to delay to a greater extent than suburban passenger trains, and express trains may have to be granted priority in the occupation of track. To eliminate the possibility of delays to main line passenger and freight trains reacting on the suburban services, and *vice versa*, it would be generally desirable that the latter should be provided with their own tracks on the surface sections of railway beyond the limits of the new tunnel system.

A complete segregation of the new cross-London services would involve much new construction in the outer areas, mainly in the form of widenings and the provision of avoiding junctions, and might not be achieved in all cases. Until decisions have been made on the scheme as a whole, it has not been thought necessary to consider in detail the steps needed to provide for the segregation of the proposed services. In any event, the altered flows of traffic resulting from the new services, and the general future development of London, would necessitate the postponement of this aspect until nearer the time of construction of the system.

**32. Parcels, newspapers, merchandise and luggage by passenger train.**—The passenger services to be placed underground at present carry extensive quantities of parcels and merchandise, and accommodation for dealing with this traffic is available at the stations and on the rolling stock. These facilities cannot be denied to the public and the trader, and provision must be made for the continuance of the traffic under the proposed arrangements.

We recognize that the handling of parcels and merchandise is potentially a source of aggravating delays, and that if this traffic is to be dealt with successfully at deep level stations new techniques will probably be required to speed-up handling and sorting and to avoid interfering with passenger movement. What is said here applies equally to heavy luggage whether it be accompanied by



passengers or not. The whole problem and its solution is likely to prove to be one of the major difficulties, and we have given considerable attention to this aspect of our proposals. These traffics are of considerable volume and are of importance to the trading community and the general public; they are also a source of profitable revenue.

Unfortunately the extensive character of the railway system to be connected to the new tunnels does not permit of a solution similar to the arrangements which were adopted by the L.P.T.B. and the L.N.E.R. when the Northern Line tube services were extended to High Barnet, in which case parcels, merchandise and heavy luggage were diverted away from the railway and dealt with by special road services focusing on neighbouring main line stations where facilities for dealing with the traffic were maintained. Under our proposals whole sections of the Southern Railway, for example, would be linked with the new lines and all surface facilities from these sections to London terminals would be withdrawn. It is inconceivable that over extensive areas the public should be deprived of what has come to be regarded as a normal railway facility, and in these circumstances a compromise solution permitting some provision for the carriage of these traffics in the new tunnels must be adopted.

We suggest, therefore, that on the new lines, facilities for handling parcels, newspapers, merchandise and luggage should be provided at those underground stations which will replace (or be located beneath) certain main line terminals, for example, those at Tower Bridge Road, Waterloo, Cannon Street, Blackfriars, Charing Cross, King's Cross, Holborn Viaduct, Paddington, Marylebone and Euston. Such traffics would be excluded entirely from all the other central area underground stations. In putting forward this suggestion, we consider that wherever practicable as much as possible of this parcels and merchandise traffic should be routed *via* the surface lines that will remain, and that every endeavour should be made to restrict the traffic to be dealt with at the underground stations concerned.

**33. Unified control of operations.**—The linking of the existing suburban lines by new cross-London underground connections, the through running of services from one side of London to the other and, where possible, the segregation of these services from other surface railway operations, would raise a number of problems concerning the organization, operation and finance of the system so established.

**34. Physical characteristics of tunnels and rolling stock.**—To accommodate rolling stock of main line railway dimensions, the diameter of the new railway tunnels should be not less than 17 ft. The station tunnels would have to be 30 ft. in diameter and the platforms at least 16 ft. wide and 650 ft. long. In laying out the running lines, the minimum permissible radius for curves should be 20 chains, and particular attention would have to be given to gradients.

There seems little doubt that the proposed underground services would necessitate the provision of rolling stock with some form of through corridor to enable passengers to pass in emergency from one coach to another, if necessary while the train is in motion. This would inevitably reduce the seating capacity of the trains. It is estimated that a 10-coach saloon type train would seat about 600 passengers, as compared with 1,050 in the latest Southern Railway "six-a-side" compartment type of train of similar length. The rolling stock for the new lines would require to be equipped with sliding and not swing doors.

## CHAPTER VII

### PROPOSALS DESIGNED TO FACILITATE THE REPLANNING OF THE SOUTH BANK OF THE THAMES

**35. Discontinuance of surface operation across the river.**—The main question to which our attention has been directed is that of the routes which should be operated underground by the projected Southern Railway services, in order to afford the most convenient facilities, with particular regard to the displacement of the Southern Railway traffic, due to the proposal to discontinue surface operation across the river. We have assumed that, allowing for development, the volume of suburban traffic to be handled will reach a maximum of 75,000 passengers in one hour, and in order to deal with this adequately we consider it would be necessary to provide five double-track railways. Main line services, however, would proceed from a new London Bridge Station (at Tower Bridge Road) to Waterloo Junction, thus making provision for a convenient interchange at Waterloo as between the Eastern and Western Sections of the Southern Railway.

This would involve the construction of a new viaduct between Tower Bridge Road and an intermediate point on the route to Waterloo Junction, and although from the planners' point of view some objection might be raised to that proposal, the viaduct would be farther from the river front than the existing one between London Bridge and Waterloo Junction, and would free the area in the neighbourhood of Southwark Cathedral from viaduct. We have assumed that all main line trains now passing through London Bridge Station, or terminating there, would be projected to Waterloo Junction by the proposed new route. Whilst the possibility of constructing this railway at sub-surface level should not be excluded, it should be noted that the necessary drop in level from Tower Bridge Road would involve blocking certain main road arteries or making provision for such roads to pass over the railway. The engineering aspects of this suggestion are too considerable to permit of our making a conclusive recommendation. Our estimates are based upon the construction of this railway on viaduct.



Our suggestions for five cross-London lines are designed to meet the movements of traffic in accordance with known trends, as a more practical alternative to the loops proposed in the County of London Plan, but it must be recognised that when it can be seen in what directions the redistribution of the population of London is proceeding, they may require modification in detail. We would repeat that, although we have not examined the economic aspects, the schemes proposed would not be likely to be self-supporting. Their origin, in fact, lies in the desire to produce a plan which will improve existing means of rail transport, thereby relieving the pressure on road traffic and meeting the aims of the planners as to amenities and the convenience of the travelling public.

**36. The scheme in outline.**—The proposed new underground railways are those numbered 1—7 on Maps Nos. 2 and 3. The principal features of the scheme are:—

- (i) Five lines in tunnel for the Southern Company's suburban services now passing through or terminating at London Bridge Station, their projection through the City and/or the West End, and their linking with suitable lines of other railways from the northern and western suburbs.
- (ii) The re-siting of London Bridge Station at Tower Bridge Road, a distance of about half a mile to the south-east of the existing site.
- (iii) The placing underground of the Southern Company's line between Loughborough Junction and Holborn Viaduct, and the alteration of its route so that from the Elephant and Castle it proceeds northwards through Waterloo to Ludgate Circus and Holborn Viaduct; thence in tunnel to Mount Pleasant and King's Cross, beyond which point it would be connected with the L.N.E.R. suburban system.
- (iv) A new underground railway for freight traffic roughly paralleling the passenger line referred to in (iii) above, but following the existing route through Blackfriars and Holborn to Farringdon, where it would join the existing Widened Lines and make contact with the main line systems to the north.
- (v) A new terminal on the site of the existing Waterloo Junction Station for the main line and outer-suburban trains now terminating at Charing Cross, Cannon Street, London Bridge and Holborn Viaduct stations.

**37. The need for five lines at London Bridge.**—In working out these proposals the factor conditioning the whole scheme is the number of underground lines required to deal with the suburban traffic now passing through London Bridge. Before the war (1938) this traffic amounted to roundly 55,000 passengers in one direction in the maximum peak hour alone, and originated on 16 different lines in the outer suburbs. The maximum peak hour traffic in 1925 was about 38,000, and the great increase, spread over the intervening period, was primarily due to (a) the growth of the outer suburbs, and (b) the greater concentration due to shorter and more standardised office hours.

As already stated in paragraphs 21 and 22, we are of the opinion that a greater dispersion of population, however systematically it may be carried out, will mean a greater volume of traffic. We, therefore, consider that provision should be made for a peak traffic of at least 75,000 passengers in the maximum hour through London Bridge.

A traffic of 75,000 passengers in one direction in one hour would, with trains accommodating 600 passengers each, require 125 trains. If a maximum track capacity of 25 trains per hour be assumed (a greater frequency is doubtful of achievement because of the intended high speed of the trains between stations), 125 trains would require five tracks. On this basis, to provide adequate facilities for the Southern Company's suburban traffic converging on London Bridge from the south-eastern and southern suburbs, not less than five double-track lines would be necessary at that point.

**38. New site for London Bridge Station.**—It would be impracticable for the whole of the five double-track lines passing through London Bridge to follow a common route through the City and West End. There are too many protective covenants, such as those relating to St. Paul's Cathedral, and too many physical obstructions in the shape of existing underground railways and sewers to enable such a proposal to be considered. It is therefore necessary to spread or fan out the paths of the new railways as they traverse the central area. While diversity in the central area routing has an advantage in enabling points to be touched which would not be possible if a common route were followed, the separate routes must create a considerable interchange of traffic at focal points, such as the station immediately before the five routes diverge, and any other station served by two or more of the lines. This interchange is inevitable and is to be seen every day on the London Passenger Transport Board's existing tube railways. It is primarily for that reason that a station on the south side of the river at or near the existing London Bridge station should be provided on the new tunnel system, and that the station should be so designed that interchange for passengers and luggage between all the lines focusing thereat can be effected as easily as possible.

It would have been desirable to have sited the new underground station below the existing station, because its proximity to the City enables it to be employed to all intents and purposes as a City station, and because of the not inconsiderable volume of traffic arising in the Borough. But under any practicable configuration of the lines north of the existing station, the point of divergence would have to be about half a mile to the south-east. As it is considered that the need for interchange facilities is of paramount importance, it is proposed that the new underground station, together with the new surface station for main line trains, should be constructed on a site adjoining Tower Bridge Road and the "A" ring road proposed in the County of London Plan.



### 39. Routes selected.

**Route 1.**—Would proceed from Tower Bridge Road under the river to Fenchurch Street and Moorgate, where it would be linked with the L.P.T.B. Northern-City line, the latter being connected at its Finsbury Park terminus with the L.N.E.R. suburban system. It is considered that the Alexandra Palace and Enfield Town branches of the L.N.E.R. might appropriately be connected with the new railway at Finsbury Park, but it must be pointed out that such a connection would involve some alteration of the scheme for dealing with the projection of the Northern-City line trains to Alexandra Palace under the New Works Programme, 1935/40. It has been found impossible to route this railway through the West End as well as the City.

**Route 2.**—Would proceed from Tower Bridge Road to the Bank, Holborn Viaduct, Holborn and thence northwards to Euston, beyond which it would be linked with the L.M.S. electrified system to Watford.

**Route 3.**—Would closely parallel Route 2 as far as Holborn, from which point it would proceed in a westerly direction to Tottenham Court Road and Bond Street, and thence turn north to Marylebone, beyond which it might be projected over the L.N.E.R. lines to High Wycombe and possibly Aylesbury.

**Route 4.**—Would proceed under the river to Cannon Street, thence to Blackfriars, Aldwych, Piccadilly, Marble Arch and Paddington. From Paddington the railway would be continued in tunnel to Maida Vale, and thence under the Edgware Road as far as Cricklewood, at which point it might be linked with the L.M.S. line to St. Albans and Harpenden.

**Route 5.**—Would proceed south of the river through Waterloo to Charing Cross; thence it would go to Piccadilly Circus (where it would have interchange connection with Route 4), Marble Arch and Paddington. Beyond Paddington it might be linked with the G.W.R. suburban system, and the trains projected through Ealing to Slough, Windsor, Taplow and Maidenhead.

**Route 6.**—In order to replace the Southern Company's line between Loughborough Junction and Holborn Viaduct, this route would proceed in tunnel from Loughborough Junction *via* Elephant and Castle, Waterloo, Ludgate Circus, Holborn Viaduct, Mount Pleasant and King's Cross to a junction with the L.N.E.R. suburban system near Finsbury Park.

**Route 7.**—Would be a new railway in tunnel for freight traffic beginning in the neighbourhood of Loughborough Junction and following the existing surface route through Blackfriars and Holborn to Farringdon, where it would join the existing Widened Lines and make contact with the main line systems to the north.

The linking of these new cross-London railways with the existing routes of the Southern Railway would require to be determined in the light of a close survey of likely traffic flows: suggestions are tabulated below:—

Route	Tunnel Portal South of Thames	S.R. Suburban Routes to be Served	Principal Destinations of Trains	
			North of Thames	South of Thames
1	New Cross Gate.	Central Section <i>via</i> Forest Hill.	Alexandra Palace and Enfield Town, L.N.E.R.	Crystal Palace, Norwood, Caterham, Tattenham Corner, Epsom Downs.
2	South Bermondsey.	Central Section <i>via</i> Tulse Hill.	Watford, L.M.S.R.	Crystal Palace, Norwood, Dorking.
3	North Kent East Junction.	North Kent ( <i>via</i> Greenwich) and Mid Kent.	High Wycombe, G.W. and G.C. Jt.; Ayles- bury, Met. and G.C. Jt.	Dartford, Gravesend, Addiscombe, Hayes.
4	Lewisham.	North Kent ( <i>via</i> Blackheath) and Bexleyheath.	St. Albans and Harpen- den, L.M.S.R.	Dartford, Gravesend.
5	Hither Green.	Dartford Loop and Chislehurst line.	Slough, Windsor, Taplow and Maidenhead, G.W.R.	Dartford, Bromley, Or- pington, Sevenoaks.
6	Loughborough Junction.	Herne Hill line and Catford Loop.	Hitchin, L.N.E.R. <i>via</i> Potters Bar and <i>via</i> Cuffley.	Crystal Palace, Orpington, Sevenoaks.
7	Loughborough Junction.	Freight.	Brent and Ferme Park Yards.	Hither Green, Herne Hill, Bricklayers' Arms and Battersea Yards.



**40. A new terminus for Southern Railway main line trains.**—A new terminus is required for the main line and outer-suburban trains at present using London Bridge, Cannon Street, Charing Cross and Holborn Viaduct stations. Because of its convenience in relation to the West End, it is suggested that the new terminus be located in part on the site of the present Waterloo Junction Station. From a traffic point of view it is eminently desirable that the new terminus should be located as near the West End as possible. Such a site would also enable direct connection between the Eastern and Western Sections of the Southern Railway to be maintained.\*

There would appear to be only one alternative to Waterloo as a terminus for long-distance trains, and that is London Bridge—or rather Tower Bridge Road—to secure interchange with the proposed new cross-London services. This alternative site has been rejected on the ground that it is far removed from the West End and is not so readily approached by road from the West End. Experience shows that, however good the system of underground railway connections may be, a considerable volume of traffic using the main line and outer-suburban services reaches and leaves the London terminals by road, either in taxis, private cars or public service vehicles. The public have enjoyed in Charing Cross a terminal in the heart of the West End, and it would cause serious inconvenience and hardship if it were removed as far as Tower Bridge Road.

We are informed that several housing projects and redevelopment schemes are imminent on sites which may be required for the new stations and their approaches. An early decision is necessary if safeguarding action is to be taken.

**41. Separate passenger and freight lines from Loughborough Junction to King's Cross.**—The scheme provides for the separation of suburban passenger from freight traffic operation on the proposed Loughborough Junction to King's Cross deep level lines. A considerable volume of freight traffic is dealt with on the present surface line, which constitutes the most important and most extensively used freight connection in London between the northern and southern railway systems. While this connection must be maintained, the use of the tracks by freight trains precludes the full development of the line for passenger services. The line should form an integral part of the system of cross-London links envisaged in the scheme, and to permit this we recommend that the passenger and freight services be divorced and that they be accommodated in entirely separate tunnels. Only in this way will the new suburban passenger line play its full part and be laid out so as to serve the more important traffic objectives in the inner zone.

## CHAPTER VIII

### PROPOSALS TO MEET IMMEDIATE TRAFFIC REQUIREMENTS

**42. Deficiencies in the railway system not covered by the County of London Plan.**—The foregoing proposals would meet a number of deficiencies which now exist in London's railway system, but they make no provision for remedying the following important defects which either exist to-day or will exist in the future as the development of London proceeds:—

#### Inner Central Zone

- (i) There is no direct railway connection between Victoria, Mayfair and Oxford Street. There has always been a heavy interchange of rail traffic to road services at Victoria, a large part of which requires the West End proper. There is also a heavy interchange traffic at Victoria to the District Line, a not inconsiderable proportion of which is required to change again at Charing Cross in order to reach West End destinations. Belgravia, Mayfair and the West End generally have undoubtedly become major objectives for business traffic.
- (ii) The present heavily used railway connection between Victoria and Euston and King's Cross is circuitous. Existing routes are either the lengthy Inner Circle or *via* the tube line at Charing Cross, which in the case of King's Cross entails a second change at Leicester Square.
- (iii) The southern sections of the Northern Line from Charing Cross and Bank to Tooting Broadway were the most heavily loaded tube lines in London before the war, and acute congestion also occurred between Golders Green and Charing Cross and between Tooting and Morden. The Northern Line has become almost saturated. Relief to the southern section is imperative at an early date, and if the traffic expands, as it may well do with the extension to Bushey under the New Works Programme 1935/40, relief must also be given to the northern section.
- (iv) The extension of the Central Line from Liverpool Street to Leytonstone and thence over the L.N.E.R. Ongar and Grange Hill branches, and the electrification of the L.N.E.R. main line to Shenfield, will throw heavy additional traffics on the Central Line. Should these develop beyond the extent contemplated when the programme was framed, relief to the section of the Central Line between Liverpool Street and the West End may become a matter of urgency.
- (v) The northern section of the Piccadilly Line was heavily loaded before the war, and with the anticipated post-war development of the areas served by the L.N.E.R. beyond Finsbury Park, traffic will increase and relief will be urgently required.

\* The suggested new Route 5 will also afford connection between the Eastern and Western Sections of the Southern Railway.



### Beyond the Inner Zone

- (i) The tracks of the Southern Railway between Balham and Victoria, and between Raynes Park and Waterloo, are used almost to capacity. There is, therefore, little or no margin for additional services to meet the probable post-war growth in traffic on the suburban lines of the Southern Railway which focus upon these congested sections.
- (ii) All trains on the Southern Company's Western Section now terminate at Waterloo; through facilities to the West End and the City would be desirable for at least a portion of the traffic in order to reduce the inconvenience of interchange and the concentration of heavy traffics at Waterloo.
- (iii) There is need to provide electric services on certain sections of the L.N.E.R. which are now operated by steam trains and which are not covered either by the New Works Programme of 1935/40 or the proposals dealt with in Chapter VII.

**43. Routes selected.**—The proposed railways are based on through connections *via* the inner central zone, and the routes selected approximately follow known traffic flows. They have also been designed to fit in with those referred to in Chapter VII, and in the result to produce a balanced and co-ordinated railway system.

Again, we desire to emphasise that the railways dealt with in this Chapter are proposed solely from considerations of traffic operation and passenger convenience. No attempt has been made to study in detail the complex engineering questions involved. Nor have the economic aspects been examined, though, having regard to the amount of tunnel construction required, the proposals cannot be regarded as having a commercial basis.

**44. Route 8.—A South to North Link—East Croydon to Finsbury Park.**—In order to provide improved rail facilities between Victoria, the West End, Euston and King's Cross, and to meet the needs of the outer zone by the electrification of the L.N.E.R. lines to Hitchin *via* Potters Bar and *via* Cuffley, this route provides for a new in-town line from Victoria to Finsbury Park, with intermediate stations at Hyde Park Corner, Bond Street, Euston and King's Cross. North of Finsbury Park the new line is linked with the L.N.E.R. system to Hitchin *via* Potters Bar and *via* Cuffley.

There is a heavy traffic carried by road services from the Streatham and Norbury district to Westminster and the West End, and the new line is projected south of Victoria as far as Croydon, thus giving relief to the congested Balham and Victoria section of the Southern Railway. The route from Victoria might be Vauxhall, Stockwell (where interchange facilities would be available with the Northern Line to the Leicester Square and Tottenham Court Road areas as well as to the City), Brixton, and thence *via* Streatham and Norbury to East Croydon.

**45. Route 9.—A South-West to North-East Link—Raynes Park to Clapton.**—To give relief to the congested section of railway between Raynes Park and Waterloo; to permit of improved train services in the south-western and north-eastern suburbs, and to give a through facility to the West End and the City, this route provides for a new line from a point near Raynes Park to a point in the vicinity of Clapton, the intermediate route being through Wimbledon, Clapham Junction, Vauxhall, Millbank, Westminster, Charing Cross, Holborn, St. Pauls, Liverpool Street and Dalston.

At Raynes Park the new railway would be linked with the Southern Company's suburban lines. North of Clapton a junction would be affected with the L.N.E.R. Chingford branch. The section between Liverpool Street and the West End would afford some relief to the L.P.T.B. Central Line, which, as pointed out above, may be necessary after the New Works Programme 1935/40 improvements to the east have been brought into service.

**46. Routes 10, 11, 12A, and 12B—Reliefs and extension to the L.P.T.B. Northern Line.**—Relief to the Kennington-Tooting Broadway section of the Northern Line is imperative, and relief between Golders Green and Charing Cross will also be necessary if the traffic on that section increases as a consequence of the various extensions under the New Works Programme 1935/40.

**Route 10** provides, as a first stage, for the construction of a new deep level tube under the existing tube line between Kennington and Tooting, where the new tracks would join the existing tracks, and the trains which at present terminate at Kennington would be projected thereover. If this deep level line were constructed, it is contemplated that the trains operating over the existing tube tracks would terminate at Tooting, while the deep level trains would be operated to Morden. In this event consideration might be given to the extension of the line (**Route 11**) from Morden to North Cheam, a densely populated area with no immediate railway facilities and now dependent on bus services. Heavy traffics are carried on the buses between Morden and North Cheam, and the extension of the railway would provide a much needed public facility. It must be emphasised that no such extension would be practicable without first providing duplicate tracks over part of the existing tube railway.

The second stage of the scheme (**Route 12A**) envisages a further deep level line, following the route of the existing Northern Line, between Golders Green and Waterloo *via* the West Central District, but this would be dependent upon the development of the traffic and the direction of the new traffic flows. It may be that some alternative scheme having the same object in view, but avoiding mere duplication of an existing railway, would prove a better proposal. For example, an entirely new tube serving Finchley, Golders Green, Baker Street, Knightsbridge, Sloane Square and Clapham Junction (**Route 12B**) might be worthy of consideration as an alternative to a deep



level railway under the Northern Line between Golders Green and Waterloo. Such an alternative tube line would give an added outlet to passengers who desire to travel to the western part of the inner zone without going through the central part; there has been for some years past a heavy road passenger movement to and from the districts lying between Knightsbridge and Baker Street.

47. **Characteristics of the railways.**—Except that Routes 10, 11, 12A and 12B would be operated with tube stock, all the lines would be subject to the considerations noted in paragraphs 28 to 34 with regard to high speed; regularity of service; parcels, newspapers, merchandise and luggage; control of operation, etc.

## CHAPTER IX

### ESTIMATES OF COST AND TIME OF CONSTRUCTION

48. **Estimated cost.**—In order to provide a guide to the probable cost of the scheme, rough computations have been made on the basis of pre-war prices and experience in the construction of tube railways. The following figures have been compiled without any engineering surveys or drawings, and are no more than indicative of the order of magnitude of the expenditure which would be involved:—

	<i>Route mileage in Tunnel</i>	<i>Millions £</i>	<i>Millions £</i>
Route 1.—Via Moorgate ... ..	8½	10	
Route 2.—Via Euston ... ..	7	10	
Route 3.—Via Marylebone ... ..	9	13	
Route 4.—Via Cannon Street and Paddington ... ..	12½	16	
Route 5.—Via Charing Cross and Paddington ... ..	12½	17	
Route 6.—Passenger line from Loughborough Junction to King's Cross ... ..	6½	10	
Route 7.—Freight line from Loughborough Junction to Farringdon ... ..	4	3	
New main line terminal at Waterloo Junction, and construction of surface station at Tower Bridge Road ...	—	7	
	60	£86	£86
Route 8.—South to North Link—East Croydon to Finsbury Park ... ..	14	24	
Route 9.—South-West to North-East Link—Raynes Park to Clapton ... ..	16	22	
Route 10.—Kennington to Tooting deep level tube ...	5	1½	
Route 11.—Extension of the Northern tube line from Morden to North Cheam ... ..	2	1½	
Route 12A.—Golders Green to Waterloo deep level tube...	6	4	
	43	£53	£53
Total ... ..			£139

**Route 12B.**—A new tube line from Finchley to Clapham Junction would cost approximately £7½ millions to construct and equip. If, therefore, this route were adopted as an alternative to the deep level line between Golders Green and Waterloo (Route 12A), the total of £139 millions would be increased to £142½ millions.

In terms of present costs, assuming for this purpose an increase of 65 per cent. on pre-war levels, the expenditure might be put at approximately £229 millions if the deep level line between Golders Green and Waterloo were constructed, and £236 millions if the alternative of a new tube from Finchley to Clapham Junction were adopted.

49. **Basis of the estimates.**—The foregoing figures must not be treated as considered estimates, but in compiling them allowance has been made for:—

- (a) The engineering works for the construction of the new railways between their points of departure from the levels of the existing lines, *but for no costs in respect of the electrification and widening of the existing railways*, or for providing any additional rolling stock that may be required for the existing railways because of the lower seating capacity of corridor type trains.



- (b) The necessary equipment for the new railways within the new tunnels, together with round figures for the provision of such rolling stock as may be required for the *net* new mileage to be run, that is to say, after deducting the present mileage into the terminals assumed to be abolished from the mileage of the railways provided in their stead.
- (c) The necessary electric power supply and extensions of car depots to accommodate the rolling stock for the *net* new mileage in (b) above.
- (d) The conjectural cost of new land and easements, and provision for compressed air works, cost of promotion, and engineering and contingencies.

50. **Period of construction.**—We are advised that, under the most favourable auspices, the period required for the completion of the underground railways included in our proposals would not be less than 30 years.

## CHAPTER X

### ORDER OF PRIORITY

51. **General principles.**—The order of priority of undertaking the works can only be settled in the light of certain pre-determined principles, and we are of the opinion that:—

- (i) The first consideration must be to provide relief for known traffics where overcrowding and inconvenience to passengers are experienced because of the inadequacy of the existing facilities.
- (ii) Existing facilities can only be withdrawn when the alternative facilities designed to replace them are sufficiently far advanced to represent an adequate substitute.
- (iii) New schemes of railway development must be closely related to town planning, new housing and industrial programmes as they emerge.

52. **Reservation with regard to future planning.**—It is not possible at this juncture to apply the third condition in full measure. Until the future plan of London is determined, therefore, all schemes of railway improvement not framed to meet urgent current needs, and any order of priority for undertaking such schemes, must be provisional and subject to modification in the light of subsequent trends and decisions. With this reservation in mind, we recommend the order of priority outlined in the paragraphs which follow. In formulating the programme we have only been able to indicate broad priorities; the schemes within each of the second, third and fourth groups would rank *pari passu*.

Any attempt to draw up engineering stage plans and to allot construction periods to individual schemes or groups of schemes would be impracticable on the basis of preliminary traffic surveys alone. To carry out proper engineering surveys, to prepare the requisite plans and drawings, and to work out a detailed programme of execution by stages relating to traffic needs and the physical resources available to undertake the work, would require a period of several years, apart from other necessary preliminaries such as securing Parliamentary powers and the raising of the necessary finance.

Wherever the execution of these proposals would involve the acquisition of surface properties, there might be advantage in carrying out the process of acquisition well in advance of the engineering works, and the placing of a scheme in a later priority should not preclude this. This would have particular point in cases where the property required has suffered bomb damage during the war.

53. **First priority.**—We are of opinion that the following six routes should be included, covering 57½ route-miles in tunnel and involving an approximate expenditure at pre-war costs of £76½ millions. They are shown in red on Map No. 3 and are described in the order in which we consider they should be accorded priority within the group:—

- (i) *Routes 6 and 7—Loughborough Junction and King's Cross passenger and freight lines.*—The construction of these underground railways would enable Blackfriars railway bridge and its approach viaducts on either side of the Thames, and the Elephant and Castle, Blackfriars and Holborn Viaduct surface stations to be removed. This would also enable certain of the L.N.E.R. and Southern Railway suburban services to be improved, and would furnish a direct rail connection between Waterloo and King's Cross. Although the civic planning possibilities opened up by this scheme have influenced our suggestion that it should be given first priority, we consider it appropriate that some major contribution towards planning should be made in the early stages of the programme. In all other schemes we have regarded traffic considerations as of first importance in determining the order of priority.
- (ii) *Route 8—South to North Link from East Croydon to Finsbury Park.*—The urgent need for improved rail facilities between Victoria, the West End, Euston and King's Cross, and the need for relieving the Southern Company's line between Balham and Victoria, justify the inclusion in the first priority of the new railway from Croydon through the inner zone to King's Cross and thence to Hitchin *via* Potters Bar and *via* Cuffley.



- (iii) *Route 10—Kennington to Tooting deep level tube.*—The provision of the deep level relief line from Kennington to Tooting Broadway on the L.P.T.B. Northern Line is imperative, in order to relieve the acute train congestion and heavy passenger loading that has obtained since some years before the war.
- (iv) *Route 4—Through Tower Bridge Road via Cannon Street and Paddington.*—This route is included in the first priority because of the urgent need to afford relief to the congested section of the Southern Company's railway between St. John's and New Cross.
- (v) *Route 9—South-West to North-East Link from Raynes Park to Clapton.*—There is urgent need to relieve the Southern Company's line between Raynes Park and Clapham Junction, and to give a proportion of the Waterloo passengers a through facility to the West End and the City. Similarly, improved services on the L.N.E.R. Chingford branch are urgently required.

#### 54. Second priority.

- (i) *Route 3—Through Tower Bridge Road via Marylebone.*—This is the next in order of priority of the five railways which would pass through the new Tower Bridge Road Station.
- (ii) *The new Tower Bridge Road Station.*—The provision of new surface and deep level stations at Tower Bridge Road should be commenced at about the same time as the work on Route 3 is begun. It is important that proper passenger interchange facilities should be available between the surface and tunnel services by the time Route 3 is brought into use. Passenger interchange between Route 4 and the surface facilities could probably be provided during the first stage at a station to the south, say, New Cross.
- (iii) *The new viaduct in the Borough.*—Simultaneously with Tower Bridge Road Station, work might be started on the viaduct across Borough High Street, in order to divert the railway to Waterloo Junction (which would be used as a terminal for main line services) away from the immediate vicinity of Southwark Cathedral.
- (iv) *Routes 12A and 12B—Relief line for the L.P.T.B. Northern Line north of the Thames.*—The question of providing relief to this line will probably become acute with the developments to be introduced under the New Works Programme 1935/40. In this event proposals on the lines of the alternative Routes 12A or 12B will have to receive consideration. It is for this reason that we have included them in this second group.
- (v) *Route 11—The extension of the Northern Tube Line to North Cheam.*—This tube extension would become practicable upon the duplication of the Northern Line between Kennington and Tooting included in first priority. There is a heavy road traffic between Morden and North Cheam, mainly in continuation of the rail journey, and alternative rail facilities are not available.

#### 55. Third priority.

- (i) *Route 5—Through Tower Bridge Road via Charing Cross and Paddington.* This line should be accorded third place in the construction of the five railways through Tower Bridge Road.
- (ii) *The new main line terminal adjoining Waterloo.* With the construction of Routes 3 and 4 completed and Route 5 in hand, a beginning would have to be made with the new main line terminal at Waterloo Junction.
- (iii) *Removal of Charing Cross Station.* When Route 5 and the new Waterloo Junction terminal have been brought into service, the existing Charing Cross Station and Hungerford Bridge could be closed to railway traffic.

#### 56. Fourth priority.

- (i) *Route 1—Through Tower Bridge Road via Moorgate; Route 2—Through Tower Bridge Road via Euston.* These railways would fall to be dealt with in the last stage of the programme.
- (ii) *Removal of Cannon Street and London Bridge Stations.* In this fourth group would come the demolition of Cannon Street Station and its approach bridge and viaducts; also the closing of the existing London Bridge Station, upon the completion of the new station at Tower Bridge Road and the new viaduct south of Southwark Cathedral.

57. **Electrification of the outer sections of railway.**—In compiling the above order of priority, it has been assumed that the electrification of, and any necessary construction in connection with, the existing surface sections of railway which would be linked with the proposed underground railways, would be so timed as to accord with the priority programme for the latter.



## PART III

### CHAPTER XI

#### CONCLUDING OBSERVATIONS

**58. General.**—The proposals contained in this report represent an attempt to discharge our terms of reference in which we are enjoined to make a contribution towards “a comprehensive scheme for the re-development of the area” and are further requested to base proposals not only on the objectives of the County of London Plan, but also specifically on “the requirements of traffic” and “the convenience of the travelling public”. We have taken “a comprehensive scheme” to mean something of the same general order of cost as the proposals in the County of London Plan which were our starting point. It will be observed that we are not asked to advise upon the question whether “a comprehensive scheme” for re-development is desirable. Nevertheless we are conscious of the fact that our proposals, taken in the aggregate, constitute a very large scheme which over the whole period would cost a great deal of money—though it is only fair to add that the annual rate of expenditure is not so formidable.

It is clear, however, that only the Government can decide whether, or when, these schemes should be carried out. There will be many other demands upon the resources of the country in the years to come, which would require a decision on the priority that our proposals should enjoy, even if they were self-financing. The decision to proceed or not will have to be taken on broad national considerations, and it should be clearly understood that the financing of schemes of this magnitude would inevitably require some form of Government assistance.

**59. Decision in principle upon the Committee's proposals.**—We would urge upon the Government that, in the first place, they should take a decision in principle upon the proposals as a whole. They are tentative in that we have not worked out all the details, particularly of the routes to be followed, and we would certainly not claim that the scheme is proof against modification. But it is a consistent whole, the parts of which fit together. It is true also that we have arranged the various proposals in an order of priority (itself subject to variation) and it is obvious that they would have to be carried out by stages.

But this does not mean that separate parts of our scheme can be treated in isolation; for example, to carry out only those which we have placed in first priority would be unbalanced, since it would include some works the primary purpose of which is to facilitate the removal of railway bridges, but which are by themselves quite ineffective for that purpose. To select the projects whose origin lay in traffic needs and reject those put in for other planning reasons would stultify the purpose of our investigation; to choose the latter projects alone would be to give an undue priority to amenities when there are crying traffic needs to be met.

We believe the scheme we have put forward, large though it is, is the smallest that can be devised to serve both its purposes at once—that is, to relieve London's traffic necessities and also make a substantial contribution to re-planning. We would ask that it be judged as a whole. If something smaller is required—with the sacrifice of one aim or the other—it would be better to start again than to pick and choose from our proposals. In that case, a precise direction from the Government would be needed.

**60. Suggested procedure.**—If the decision in principle is favourable, we would strongly recommend that:—

- (a) Immediate steps should be taken to investigate our proposals as a whole from the engineering aspect and to ensure full co-ordination.

The best means of doing this would be to set up an organization specifically charged with this study, which would involve detailed consideration of underground conditions.

- (b) As soon as this investigation has proceeded far enough to ensure the practicability of the scheme as a whole, the same body should turn to the preparation of detailed plans for the six projects which we have placed in first priority, namely, in order, Routes 6 and 7, 8, 10, 4 and 9.

Even if a start on the actual works had to be deferred because of more pressing needs, this body should be set up as soon as a favourable decision in principle is taken.

### CHAPTER XII

#### SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

**61.** The following summary is an attempt to tabulate the specific conclusions we have reached. For the precise nature of the recommendations, however, and for the arguments on which they are based, reference should in every case be made to the main body of the report.

**62. General principles.**—(Paragraph 15)

- (a) As a general proposition, the railways for passenger and goods operation should be electrified, priority being given to completing the electrification of suburban passenger services.



- (b) Loop working is not a practicable proposition.
- (c) The underground system should, in general, be separated from the main line tracks so far as inter-running is concerned.
- (d) Deep level stations for suburban traffic carried in standard size rolling stock are possible, provided (i) sliding-door stock is used, and (ii) services are arranged to localise the handling of heavy luggage and parcels traffic without inconvenience.
- (e) It is possible to project suburban traffic across London in tunnel.
- (f) Deep-level stations for long-distance main line traffic are impracticable, but sub-surface terminals (say 20 to 30 feet below road level) could be operated where conditions are favourable.

**63. Conclusions on proposals in the County of London Plan.**—(Paragraphs 16 and 17)

- (a) The deep-level loop from London Bridge to Waterloo, Charing Cross, Cannon Street and back to London Bridge (Project B on Map No. 1) is not recommended.
- (b) The North Bank Link at deep level, from Clapham Junction to Deptford (Project A on Map No. 1), is not recommended.
- (c) The North-South deep level line from Snow Hill to Loughborough Junction (Project C on Map No. 1) is recommended, subject to minor amendment, in the Committee's own proposals.
- (d) Preliminary consideration of the Northern Arc (Project D on Map No. 1) suggests that it should not be approved.
- (e) Charing Cross and Cannon Street stations should not be removed until alternative facilities have been provided. The existing prohibition on any improvement to Charing Cross Station should be withdrawn.

**64. Railway Development as related to Housing and Industry.**—(Paragraphs 18 to 22)

The factors which affect the volume of traffic and the provision of transport in the Greater London Area are :—

- (a) *The future population of the area.*—It is assumed that this will not change appreciably in magnitude for the next generation.
- (b) *Its distribution within the area.*—The tendency for a wider dispersion of residence will continue.
- (c) *Travel from home to work.*—The satellite town proposals of the Greater London Plan are designed to unite residence with work, and if future development is on these lines, as compared with the suburban sprawl of the past, it should result in the volume of travel between home and work being much less than such a dispersion of the population would otherwise have made it. On the other hand, it is not understood to be the intention that compulsion should be used either to limit residence in satellite towns to those who work there or to restrict their industries to local labour.
- (d) *Social habits.*—As income rises, the demand for transport can be expected to rise more than proportionately.
- (e) *The magnitude of the rush hour peak.*—The prospect of reducing this is not encouraging.

For all these reasons, we conclude that the volume of travel, as measured in passenger journeys and still more in passenger-miles, will continue to increase.

**65. Outline of the Committee's proposals.**—(Paragraphs 25 to 34)

- (a) In order to provide for the removal of Charing Cross and Cannon Street stations, all suburban services on the Eastern Section of the Southern Railway now terminating at these stations should be put into tunnel.
- (b) Similarly, suburban services on the Central Section now terminating at London Bridge should be put into tunnel.
- (c) Suitable provision should be made for a new terminus for main line trains now terminating at Charing Cross, Cannon Street, London Bridge and Holborn Viaduct.
- (d) The tunnels should be projected across London so as to secure through running with the suburban services of the other main line companies.
- (e) The tunnels should be of diameter large enough to take standard-size stock. They should be designed for high speed operation, with a limited number of in-town stations, located as near as physical conditions permit to focal points on the existing underground system.



- (f) In general, these cross-London services should be provided with their own tracks on the surface sections beyond the limits of the new tunnel system.
- (g) Facilities for handling parcels, newspapers, merchandise and luggage should be provided in the new tunnels only at the stations to be located beneath the present main line terminals.

**66. Proposals designed to facilitate the re-planning of the South Bank.**—(Paragraphs 35 to 41, and Maps Nos. 2 and 3)

- (a) The major proposal under this head is for five lines in tunnel all diverging from a new deep level station under the Southern Railway at Tower Bridge Road. These are:—

**Route 1.**—Via Fenchurch Street and Moorgate, connecting there with the existing Northern City line to Finsbury Park and thence with the Alexandra Park and Enfield Town branches of the L.N.E.R.

**Route 2.**—Via Bank, Holborn Viaduct, Holborn, Euston and the L.M.S. line to Watford.

**Route 3.**—Via Bank, Holborn, Tottenham Court Road, Bond Street, Marylebone and the L.N.E.R. line to High Wycombe and perhaps Aylesbury.

**Route 4.**—Via Cannon Street, Aldwych, Piccadilly Circus, Marble Arch, Paddington, Maida Vale, Cricklewood and the L.M.S. line to St. Albans and Harpenden.

**Route 5.**—Via Waterloo, Charing Cross, Piccadilly Circus, Marble Arch, Paddington and the G.W.R. suburban system.

- (b) The proposal in the County of London Plan for a North-South deep level line is incorporated as follows:—

**Route 6.**—A line in tunnel for passenger traffic from Loughborough Junction *via* Elephant and Castle, Waterloo, Ludgate Circus, Holborn Viaduct, Mount Pleasant, King's Cross, and connecting with the L.N.E.R. suburban system near Finsbury Park.

**Route 7.**—A line in tunnel for freight traffic from Loughborough Junction, following the existing surface route through Blackfriars and Holborn to Farringdon, where it would join the existing "Widened Lines" and make contact with the main line system to the north.

- (c) London Bridge Station would have to be moved about half a mile to the south-east and a new station built at Tower Bridge Road, beneath which would be the deep level station from which Routes 1 to 5 would diverge.

- (d) A new terminal for main line trains should be built at Waterloo Junction, and surface trains (*i.e.*, main line traffic) should reach this station from Tower Bridge Road by a partly or wholly new route running to the south of the present viaduct.

**67. Proposals to meet immediate traffic requirements.**—(Paragraphs 42 to 47, and Maps Nos. 2 and 3)

- (a) **Route 8.**—A new line from East Croydon in tunnel from Norbury *via* Streatham, Brixton, Stockwell, Vauxhall, Victoria, Hyde Park Corner, Bond Street, Euston, King's Cross and Finsbury Park, beyond which connection would be made with the L.N.E.R. routes to Hitchin *via* Potters Bar and *via* Cuffley. The purpose of this route is (i) to relieve the heavy pressure on the railway between Balham and Victoria, and (ii) to provide badly needed cross-town communication from Victoria.

- (b) **Route 9.**—A new line in tunnel from Raynes Park (where connection would be made with the Southern Railway) *via* Wimbledon, Clapham Junction, Vauxhall, Millbank, Westminster, Charing Cross, Holborn, St. Paul's, Liverpool Street, Dalston and Clapton, where connection would be made with the Chingford Branch of the L.N.E.R. The purposes of this route are, among others, to provide relief for the Southern Railway between Raynes Park and Waterloo, and, between the West End and Liverpool Street, to provide relief for the L.P.T.B. Central Line, which will be overloaded when the schemes included in the 1935/40 programme are complete.

- (c) Relief is also needed for the L.P.T.B. Northern Line. **Route 10** would double the existing tube between Kennington and Tooting. **Route 11** would extend the same tube from Morden to North Cheam. **Routes 12A and 12B** are *alternative* proposals for relieving the Northern Line between Waterloo and Golders Green. **Route 12A** would be a doubling of the existing tube on its present alignment. **Route 12B** would be a new tube line from East Finchley *via* Golders Green, Baker Street, Knightsbridge and Sloane Square to Clapham Junction.

**68. Priority and cost.**—(Paragraphs 48 to 57)

The order of priority of construction of these schemes and their estimated cost are shown below. The costs are stated in terms of pre-war prices; they are only approximate and the definitions of what they include are stated in paragraph 49. It is intended that the six schemes included in first priority should be constructed in the order stated. Schemes included in each of the later priorities are intended to rank *pari passu*.



	Route Mileage in Tunnel	Approximate Cost at Pre-war Prices £ millions
FIRST PRIORITY		
Routes 6 and 7.—North-South passenger and freight tunnels, Loughborough Junction to King's Cross ... ..	10½	13
Route 8.—East Croydon to Finsbury Park ... ..	14	24
Route 10.—Kennington to Tooting relief tube ... ..	5	1½
Route 4.—Tower Bridge Road—Cannon Street—Paddington—Cricklewood—L.M.S. line to Harpenden ... ..	12¼	16
Route 9.—Raynes Park to Clapton ... ..	16	22
Removal of Blackfriars and Holborn Viaduct surface stations ... ..	—	—
	57¾	76½
SECOND PRIORITY		
Route 3.—Tower Bridge Road—Holborn—Marylebone—L.N.E.R. line to High Wycombe ... ..	9	13
New Tower Bridge Road surface station ... ..	—	3¾
New Viaduct in the Borough ... ..	—	¾
Route 12A or 12B.—Relief tube for Northern Line (either Waterloo to Golders Green or Clapham Junction to Finchley) ... ..	6	4 or 7½*
Route 11.—Morden to North Cheam ... ..	2	1½
THIRD PRIORITY		
Route 5.—Tower Bridge Road—Charing Cross—Paddington—G.W.R. line to Maidenhead ... ..	12½	17
New Terminal at Waterloo Junction ... ..	—	2½
Removal of Charing Cross Station ... ..	—	—
FOURTH PRIORITY		
Route 1.—Tower Bridge Road—Moorgate—Finsbury Park—L.N.E.R. line to Alexandra Palace and Enfield Town ... ..	8¾	10
Route 2.—Tower Bridge Road—Euston—L.M.S. line to Watford ... ..	7	10
Removal of Cannon Street and London Bridge Stations ... ..	—	—

The total of these costs is £139 millions (or £142½ millions if Route 12B replaces 12A). If post-war prices exceed the pre-war level by 65 per cent., the post-war cost would be £229 millions or £236 millions respectively. These totals do not include the cost, which would be heavy, of any electrification or other work outside the proposed new tunnels.

The period required for construction, under the most favourable conditions, would not be less than 30 years.

#### 69. Concluding observations.—(Paragraphs 58 to 60)

This report is not intended to determine whether such a large scheme as this is justifiable or not. But we consider that this is the smallest scheme that can be devised to secure, at one and the same time, that substantial areas of Central London are freed for re-planning, and that the traffic needs of the public are provided for.

We recommend that the proposals be considered as a whole and that, if they are to be adopted, an immediate start should be made by an organisation specifically charged with the necessary preparatory work.

\* That is, £4 millions for Route 12A or £7½ millions for Route 12B.



70. **Further investigations.**—We are proceeding to consider the recommendations made in the County of London Plan as regards certain main line terminals, and particularly in respect of the provision of inner and outer goods rings by utilising the northern half of the Inner Circle, and by new construction.

71. We record with deep regret the untimely death of our distinguished colleague Mr. C. E. Fairburn, M.A., M.I.C.E., M.I.Mech.E., M.I.E.E., M.I.Loco.E., Chief Mechanical and Electrical Engineer, London, Midland and Scottish Railway. During his illness, Mr. S. H. Fisher, Chief Operating Manager, kindly afforded us his advice.

Mr. F. A. Harper, Principal Assistant to the Chief Mechanical and Electrical Engineer, London, Midland and Scottish Railway, whom you appointed to succeed Mr. Fairburn as a member of the Committee, was in America at the time of his appointment. In his absence Mr. H. B. Bailey, Personal Assistant to the Chief Mechanical and Electrical Engineer, attended our meetings on his behalf.

We desire to express our cordial thanks to the officers of the Main Line Companies and the London Passenger Transport Board who have given us the benefit of their expert knowledge and have spent much valuable time advising upon the complicated issues concerned.

We also wish to record our appreciation of the excellent work of our Secretarial Staff. One of the two Co-Secretaries, Miss Champ, of the Ministry of Town and Country Planning, was with us for the whole period. Her colleagues from the Ministry of War Transport were in succession Mr. G. S. Pryde, Brigadier P. L. Spafford and Mr. J. L. Stewart Moore. From all of these and from the supplementary members of the Secretarial Staff we received most able, willing and energetic help.

We have the honour to be, Sir,

Your obedient Servants,

C. E. INGLIS (*Chairman*)  
GEOFFREY CROWTHER  
F. A. HARPER  
E. J. MISSENDEN  
ALAN MOUNT  
GEORGE L. PEPLER  
THEODORE E. THOMAS  
J. C. L. TRAIN

H. CHAMP	}	<i>Joint Secretaries</i>
J. L. STEWART MOORE		

21st January, 1946.



## APPENDIX

## CALCULATION OF COST OF RAILWAYS PROPOSED IN THE COUNTY OF LONDON PLAN

As the County of London Plan does not detail the number of tracks required for the various routes proposed, the engineers consulted by us took out estimates on a "unit" basis, *i.e.*, one pair of tracks per route, with additional units for branches and lay-overs. To assess the total cost, an arbitrary decision as to the number of tracks which would be required must be made.

The following assessment of cost is based, therefore, on the general assumption that the North Bank Route (Project A) should have 8 tracks (4 pairs); the South-East, City and West End Route (Project B), 2 tracks (1 pair) round the loop portion, and 4 tracks below London Bridge; the North-South Route (Project C), 2 pairs (4 tracks); and the Northern Arc (Project D), 1 pair (2 tracks).

With the necessary branches and lay-overs the cost on this basis would work out at:—

	£	£	£
<b>NORTH BANK ROUTE</b>			
Main Route	5,230,000 × 4 pairs	20,920,000	
Clapham Branch	660,000 × 4	2,640,000	
Brixton Branch	970,000 × 2	1,940,000	
Deptford Branch	530,000 × 1	530,000	
New Cross Branch	690,000 × 2	1,380,000	
New Cross Gate Branch	810,000 × 2	1,620,000	
Lay-over at Charing Cross	460,000 × 4 units	1,840,000	
			30,870,000
<b>SOUTH-EAST, CITY AND WEST END ROUTE</b>			
Main Route (4 lines below London Bridge)	5,590,000 × 1 pair	5,590,000	
Lay-over at Charing Cross	460,000 × 1 unit	460,000	
			6,050,000
<b>NORTH-SOUTH ROUTE</b>			
Main Route	2,400,000 × 2 pairs	4,800,000	
Lay-over at Holborn	460,000 × 2	920,000	
			5,720,000
<b>NORTHERN ARC ROUTE</b>			
Main Route	6,450,000 × 1 pair	6,450,000	
Lay-over	460,000 × 1 unit	460,000	
			6,910,000
	TOTAL SCHEME...	£49,550,000	
	Say...	£50,000,000	

It is considered that, as the basic estimate excludes land, property, easements, permanent way, signalling, traction equipment, rolling stock and "finishings" of stations, the cost of the routes as shown should be doubled—giving a figure of £100,000,000 at *pre-war prices*.

This cost does not, however, cover the many ancillary surface works which would be required—flying and burrowing junctions, the replacement of goods terminals, the provision of new carriage depots, etc. These would involve a large expenditure which at pre-war prices may be in the region of £10,000,000.



# MAP NO 1.

## COUNTY OF LONDON PLAN 1943

### SUGGESTED DEEP LEVEL RAILWAY ROUTES

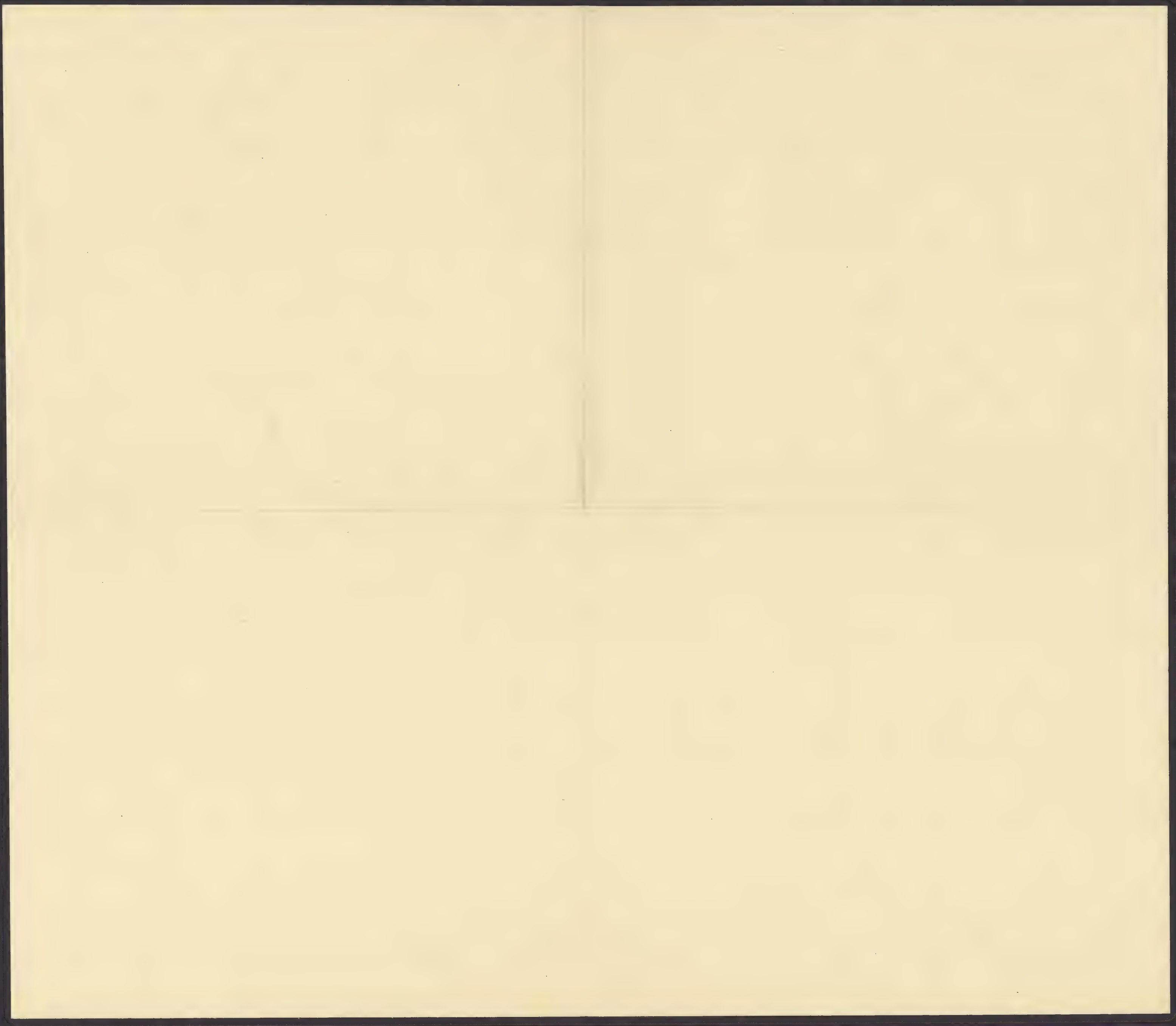


- PROJECT A
- PROJECT B
- PROJECT C
- PROJECT D

1 MILE. 3/4 1/2 1/4 0 1 MILE.  
SCALE.

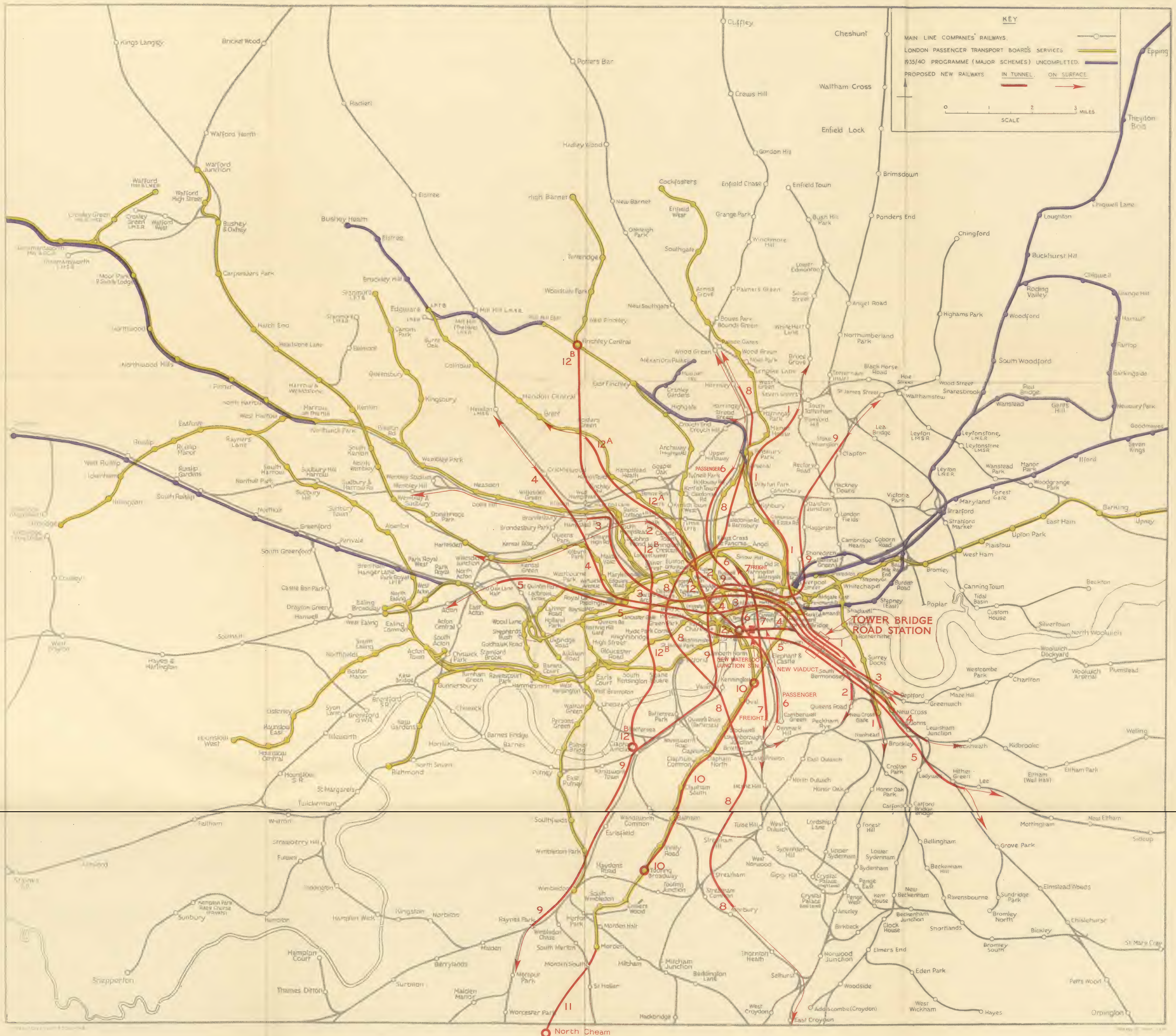








## MAP NO 2

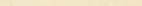




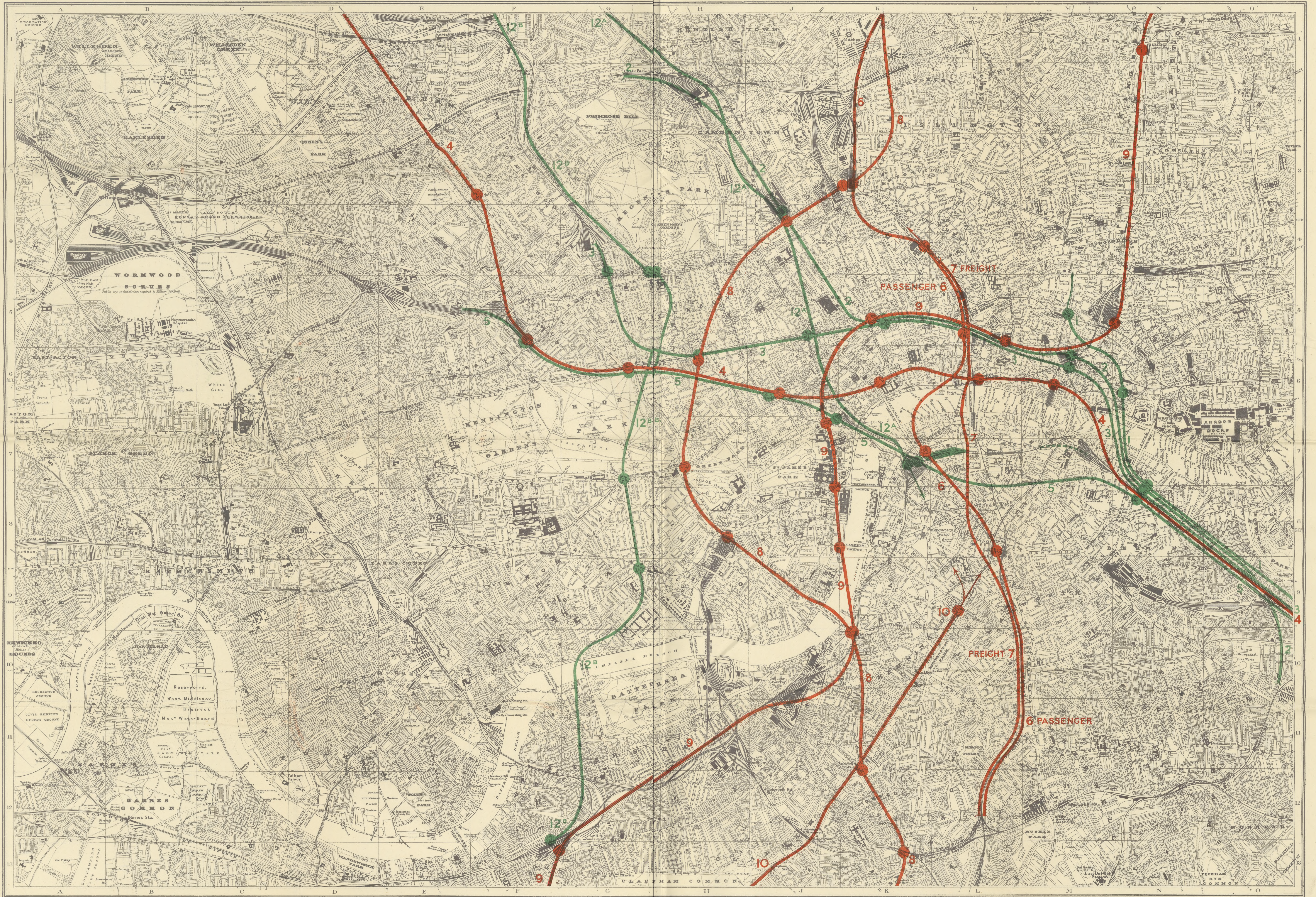




MAP NO 3.

FIRST PRIORITY ROUTES   
OTHER PROPOSED ROUTES 

NOTES: THE ROUTES SHOWN ARE APPROXIMATE; NO SURVEYS HAVE BEEN  
MADE AND THE MAP SHOULD BE REGARDED AS DIAGRAMMATIC ONLY.  
(SEE PARAGRAPHS 23, 48, 52 & 59)



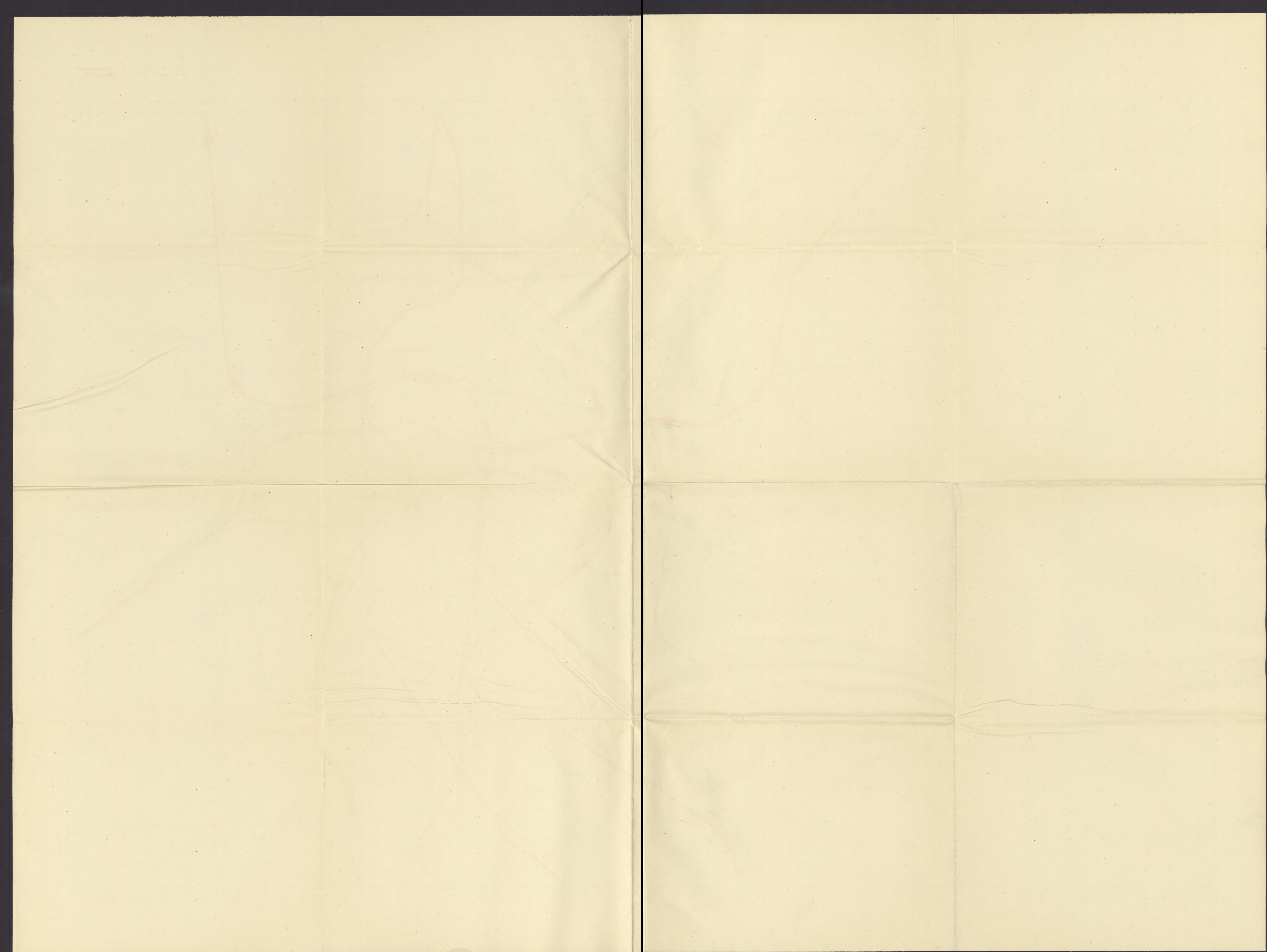
Based on Stanford's 4<sup>th</sup> map of Central London.

Scale: 4 Inches to 1 Statute Mile

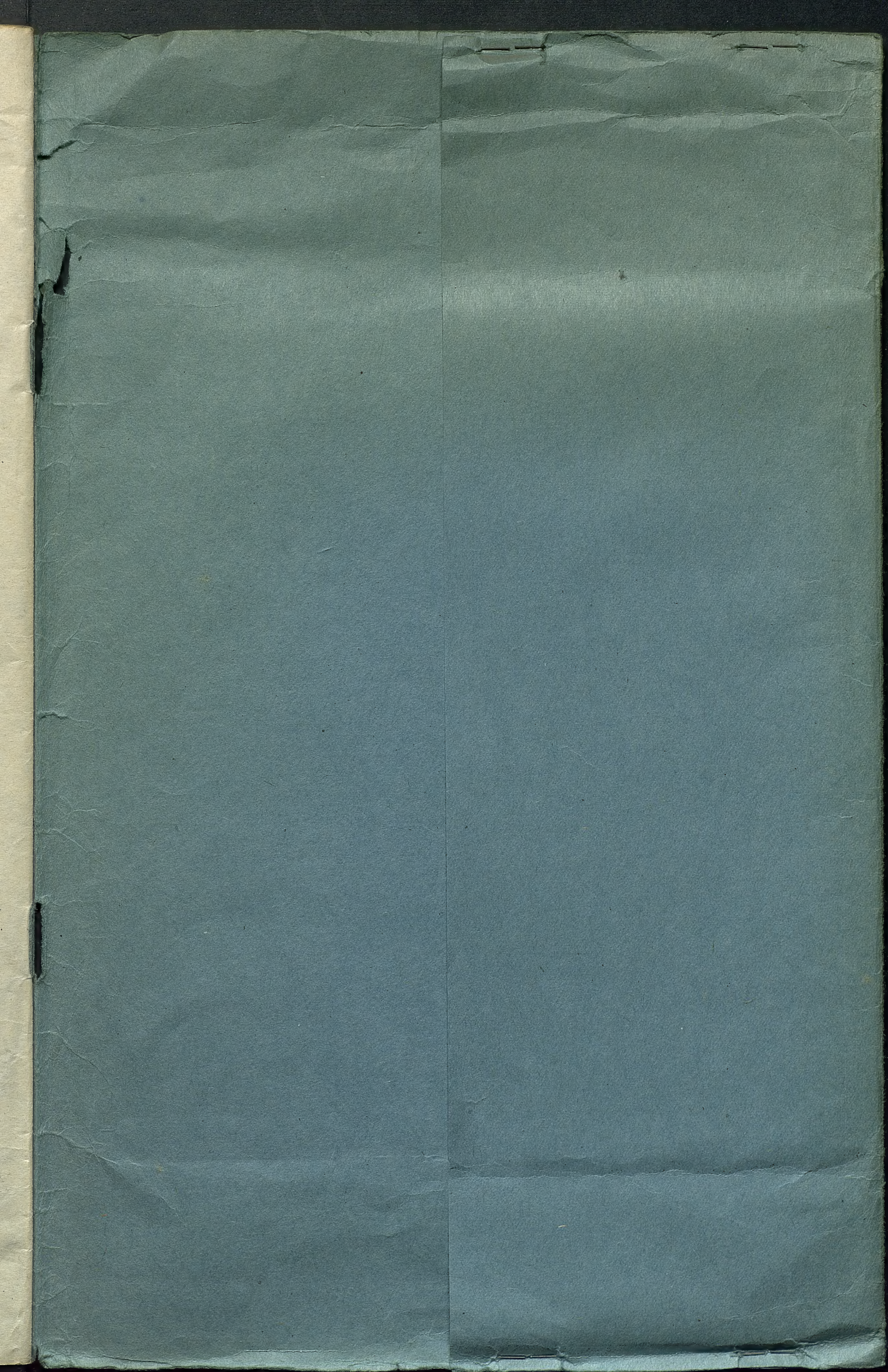
A horizontal scale bar with two rows of markings. The top row is labeled '0', '500', '1000', '500', '1500 YARDS'. The bottom row is labeled '0', '1/4', '1/2', '3/4', '1 MILE'. The bar is divided into segments corresponding to these markings.

The "Underground" Railways with connections...  Sta.











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